AN ANALYTICAL APPROACH IN SOLVING A SYSTEM OF NONLINEAR DIFFERENCE EQUATIONS

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ABSTRACT

We re-examine the system of difference equations given by

$$x_{n+1} = \frac{x_{n-(2k-1)}}{\varepsilon+\delta x_{n-(2k-1)}y_{n-(k-1)}}, \qquad y_{n+1} = \frac{y_{n-(2k-1)}}{\rho+\sigma y_{n-(2k-1)}x_{n-(k-1)}},$$

where $\varepsilon, \delta, \rho, \sigma \in \{-1,1\}$ and $k \in \mathbb{N}$, with the real initial values $\{x_n\}_{n=-(2k-1)}^{0}$ and $\{y_n\}_{n=-(2k-1)}^{0}$ such that $\delta x_{m-(k-1)} \neq -\varepsilon$ and $\sigma y_{m-(2k+1)} \neq -\rho$ for all possible values of m and k. We present an analytical approach to derive the closed-form solution of the given system. Our technique uses appropriate substitutions on the phase variables coupled with the application of the method of differences.