DYNAMICAL SOLUTIONS OF THE THIRD ORDER RATIONAL DIFFERENCE EQUATION TO A NON LINEAR EXTENDED KALMAN FILTER

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Abstract

In this paper we analyzed the global character and solutions of the following third-order rational difference equation,

$$x_{n+1} = \frac{\alpha x_n + \beta x_{n-2}}{A + B x_n}, \quad n = 0, 1, 2, \cdots \tag{1}$$

with positive parameters α, β, A, B and arbitrary nonnegative initial conditions x_{-2}, x_{-1}, x_0. Further we derived the global asymptotic stability of positive equilibrium conditions of (1). We are primarily concerned with the boundedness nature of solutions, the stability of the equilibrium points, the periodic character of the equation and convergence to periodic solutions. The methods and techniques we develop to understand the dynamics of various special cases of rational difference equations and the theory that we obtain will also be useful in analyzing the equation in any mathematical model that involves difference equations. It is implemented into various filters especially a non liner extended Kalman filter and its design. The paper describes a simulation study using Matlab.

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