Stability and flip bifurcation of a three dimensional exponential system of difference equations

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October 20, 2020

Abstract

In this paper, we study the stability of the zero equilibrium and the occurrence of flip bifurcation on the following system of difference equations: \[x_{n+1} =a_1\frac{y_n}{b_1+y_n} +c_1\frac{x_ne^{k_1-d_1x_n}}{1+e^{k_1-d_1x_n}},\]\\ \[y_{n+1} =a_2\frac{z_n}{b_2+z_n} +c_2\frac{y_ne^{k_2-d_2y_n}}{1+e^{k_2-d_2y_n}},\]\\ \[z_{n+1} =a_3\frac{x_n}{b_3+x_n} +c_3\frac{z_ne^{k_3-d_3z_n}}{1+e^{k_3-d_3z_n}}\] where a_i, b_i, c_i, d_i, k_i, for $i=1,2,3$, are real constants and the initial values x_0, y_0 and z_0 are real numbers. We study the stability of this system in the special case when one of the eigenvalues is equal to -1 and the remaining eigenvalues have absolute value less than 1, using center manifold theory.

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