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GLOBAL STABILITY OF SOME NONLINEAR HIGHER-ORDER SYSTEMS OF DIFFERENCE EQUATIONS

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Abstract. We study the boundedness character and global stability of the positive solutions of the following systems of non-linear difference equations:

$$x_{n+1}=\frac{\alpha+\sum_{i=0}^{k}\beta_i e^{-y_{n-i}}}{A+y_{n-p}},\qquad y_{n+1}=\frac{\xi+\sum_{i=0}^{k}\gamma_i e^{-x_{n-i}}}{B+x_{n-p}},$$

$$x_{n+1}=\frac{\alpha+\sum_{i=0}^{k}\beta_i e^{-y_{n-i}}}{A+x_{n-p}},\qquad y_{n+1}=\frac{\xi+\sum_{i=0}^{k}\gamma_i e^{-x_{n-i}}}{B+y_{n-p}},$$

and

$$x_{n+1}=\frac{\alpha+\sum_{i=0}^{k}\beta_i e^{-x_{n-i}}}{A+y_{n-p}},\qquad y_{n+1}=\frac{\xi+\sum_{i=0}^{k}\gamma_i e^{-y_{n-i}}}{B+x_{n-p}},$$

where n, k, $p\in\mathbb{N}=\{0,1,2,...\}$, the parameters A, B, α, ξ, β_i, γ_i, for $i=0,\ldots,k$, are positive constants and the initial values x_{-s}, x_{-s+1}, $\ldots$, x_0, y_{-s}, y_{-s+1}, $\ldots$, y_0 are nonnegative real numbers, with $s=\max\{k,p\}$.

Keywords. Nonlinear systems of difference equations, boundedness, equilibrium points, global asymptotic stability.

AMS (MOS) subject classification: 39A10.

1 Introduction and Preliminaries

The idea of using difference equations to approximate solutions of differential equations appeared in the eighteenth century ([9], [13]). This discovery attracted after the attention of researchers who attempted to apply the results to fields from economics, sciences and engineering to medicine and life sciences (e.g. in population dynamics, ecology, epidemiology, ... etc).

In recent years, theory and applications of difference equations and systems have developed rapidly, and several various monographs and papers have been published, (see, e.g. [1]-[13], [16]-[19]). Stability criteria is of a paramount importance in the description and the study of difference equations and systems of difference equations which can have different asymptotic behaviors in function of their parameters.