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On some properties of stability for difference equations

We consider a perturbed nonlinear system of difference equations in the form

$$x(n + 1) = Ax(n) + F(n, x(n), Tx(n)), \tag{1}$$

where A denotes the constant matrix $k \times k$, T is the continuous operator and the function $F : \mathbb{N}(n_0) \times \mathbb{R}^k \times \mathbb{R}^k \to \mathbb{R}^k, F(n, 0, 0) \equiv 0$.

A similar form of (1) is the system

$$x(n + 1) = Cx(n) + B(n)x(n) + F(n, x(n), Tx(n)), \tag{2}$$

where $B(n) = A(n) - C$, $C = const.$

In the paper several new sufficient conditions for the property $F(\alpha, M)$, i.e. $\|x(n)\| \leqslant Me^{-\alpha(n-m)}\|x(m)\|$ for $x_0 \in \{x : \|x\| < r\}$ of perturbed system (1) and (2) are given.