

1116-39-594

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Exponential Stability And Instability In Multiple Delays Difference Equations.

We use Lyapunov functionals and obtain sufficient conditions that guarantee exponential stability of the zero solution of the difference equation with multiple delays

$$x(t+1) = a(t)x(t) + \sum_{j=1}^k b_j(t)x(t-h_j)$$

The novelty of our work is the relaxation of the condition $|a(t)| < 1$, in spite of the presence of multiple delays. Using a slightly modified Lyapunov functional, we obtain necessary conditions for the unboundedness of all solutions and for the instability of the zero solution. We provide an example as an application to our obtained results.

(Received September 08, 2015)