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Section:

9. Ordinary Differential Equations and Dynamical Systems

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On the asymptotic behavior of solutions of nonlinear difference equation

We consider the nonlinear difference equation

$$\Delta^2 x_n = \sum_{i=0}^{k} a_n^i f_i(x_{n+i}) + b_n$$

where $a_n^i, b_n \in R$, $f_i : R \to R$, $i = 0, 1, \ldots, k$. Using the Schauder fixed point theorem we prove that if the series $\sum_{n=1}^{\infty} n a_n^i$, $\sum_{n=1}^{\infty} b_n$ are absolutely convergent and the function f_i are continuous then for every constant $c \in R$ there exists a solution (x_n) of the equation convergent to c. Moreover, if the functions f_i are bounded and uniformly continuous then for every $c, d \in R$ there exists a solution (x_n) which possesses the asymptotic behavior $x_n = cn + d + o(1)$.

Reference: 1. M. Migda, J. Migda, Asymptotic properties of the solutions of the second order difference equation, (submitted). 2. J. Popenda, E. Schmeidel, On the asymptotic behavior of nonhomogeneous linear equation, *Indian J. Math. 28(3)*, (1997), 319–327.