EXISTENCE OF ALMOST PERIODIC SOLUTIONS OF NEUTRAL DELAY DIFFERENCE SYSTEMS

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Abstract. In the present paper, we study the properties of almost periodic solutions for neutral delay difference systems and establish some theorems on the existence of almost periodic solutions for neutral delay difference systems by means of Liapunov functionals. The obtained results confirm not only the existence, but also the uniqueness as well as the uniform asymptotic stability of the almost periodic solution.

Keywords. Neutral delay difference systems, almost periodic solutions, almost periodic sequence, uniformly almost periodic sequence, Liapunov functionals.

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1 Introduction

In the previous paper[4], authors investigated the almost periodicity of delay difference systems and established the existence of almost periodic solutions for the finite delay difference systems of the general form in terms of the discrete Liapunov functionals. However, to the best of our knowledge, there have only appeared several results on oscillations and asymptotic behaviors of some specific neutral delay difference equations, and some stability results for neutral delay difference equations of the general form [3], but we have not seen any almost periodicity results for neutral delay difference equations so far. To deal with such problems, in section 2 we will introduce some notions, criteria and the basic properties about the almost periodic sequences, asymptotically almost periodic sequences, and uniformly almost periodic sequences. Then, based on these results, we provide several criteria of existence of almost periodic solutions for neutral delay difference systems in section 3. Especially, some existence theorems of almost periodic solutions for neutral delay difference equations with nonautonomous operator are shown by means of discrete Liapunov functionals in section 4. In this way, we generalize the applications of discrete Liapunov functionals to the existence of almost periodic solutions for neutral delay difference systems.

For convenience, in the sequel, we always assume that the variables $n, m, s,$ $i, j, k, \alpha, \beta, \gamma, \tau, \sigma$ take integer values and the corresponding inequalities as well as the relevant intervals are discrete ones.