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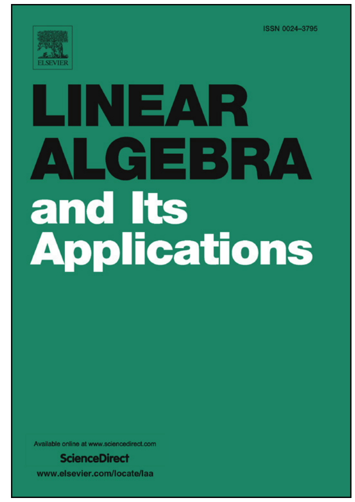


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# Exponential Stability of Time-Varying Linear Discrete Systems

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**Abstract**

We are concerned with the stability of non-autonomous linear discrete-time systems. Two necessary and sufficient conditions are derived for exponential stability of time-varying linear discrete-time systems. They show that through a nonsingular state transformation an exponentially stable system can be reduced to a simple one with the coefficient matrix whose spectral norm being less than unity. Furthermore, an estimation of solution of time-varying linear discrete-time system is provided which extends the results in the literature.

**AMS classification** 65F10, 65F15
Keywords: varying-time discrete systems, exponential stability, spectral norm of matrix



## 1 Introduction

We are concerned with a non-autonomous linear discrete-time system given by the linear state equation

$$\begin{cases} x(k+1) = A(k)x(k), \\ x(k_0) = x_0 \end{cases} \tag{1}$$

where the $n \times 1$ vector sequence $x(k)$ is called the sate vector and the $n \times n$ matrix sequence $A(k)$ the coefficient matrix. The default assumption on the coefficient matrix $A(k)$ is that it is a real matrix sequence defined for every integer $k \in \mathbb{Z}$.

The continuous analog of discrete system (1) is the following equation

$$\dot{z}(t) = G(t)z(t), \tag{2}$$