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On Stability Conditions of Singularly Perturbed Nonlinear Lur'e Discrete-Time Systems

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Abstract: This paper deals with stability of discrete-time nonlinear Lur'e-type systems. Through the singular perturbations technique, the original system is reduced to a block-diagonal form with slow and fast decoupled modes. Stability conditions of the two-time-scale decoupled model based on Borne-Gentina practical stability criterion and the use of matrices in the Benrejeb arrow form are developed and compared with those concerning the original discrete-time system. It is shown that these results are practical and less conservative then the existing ones. A third order system is introduced to illustrate the efficiency of the proposed approach.

Keywords: *discrete Lur'e systems; singular perturbations technique; two-time-scale systems; stability; arrow form matrix.*

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1 Introduction

During the past several decades, the stability problem of dynamical systems has attracted an immense attention in the control society. A great majority of the encountered problems is concerned with the closed-loop behavior of feedback nonlinear systems. An important and typical class of such systems is Lur'e-type systems introduced by Lur'e and Postnikov [39], and described by combinations of a dynamic linear bloc and a feedback interconnected to a static nonlinearity, assumed to lie in a given sector. Since that,

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