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Unified Continuous and Discrete Lur'e Systems Stability Analysis Based on Augmented Model Description

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Abstract: The proposed unified approach for stability analysis of nonlinear Lur'e continuous- and discrete-time systems is based on a unified Borne-Gentina practical stability criterion and augmented systems description. New Lur'e systems stability conditions are developed and compared with the original ones. An illustrative example is considered to show the efficiency of the proposed stability approaches.

Keywords: *Lur'e systems; augmented models; stability; vector norms; arrow form matrix.*

Mathematics Subject Classification (2010): 93C55, 93D09, 93D15.

1 Introduction

The presence of model nonlinearities in most control problems is still a big challenge for modern control theory [2, 6, 7] since there is no universal design procedure for nonlinear systems. Lur'e systems [3] represent an important and common class of nonlinear systems and refer to such systems that consist of a linear dynamical system and a nonlinear feedback loop satisfying certain sector conditions.

The stability of Lur'e systems is stated, first, as an absolute stability problem of the equilibrium point at the origin, then, as the asymptotic stability for any nonlinearity belonging to certain section conditions. Later, different stability criteria are derived via different forms of Lyapunov functions (LFs): the classical quadratic LF [16], non-quadratic Lur'e-type LF [3], the piecewise quadratic LF [1] and fuzzy LF [20].

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