



## **$L_2$ -STABILITY ANALYSIS OF PROPORTIONAL TAKAGI-SUGENO FUZZY CONTROLLER BASED CONTROL SYSTEMS**

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**ABSTRACT**—In this paper, the mathematical properties of the proportional Takagi-Sugeno (T-S) fuzzy controller are first investigated. Based on these properties, the  $L_2$ -stability of the fuzzy control systems, in which the proportional T-S fuzzy controller is utilized, is analyzed by using the well-known circle criterion. A sufficient condition with elegant graphical explanation in the frequency domain is next derived to guarantee the  $L_2$ -stability of the fuzzy control systems. Finally, the proposed sufficient condition is examined with two numerical simulations.