

## STABILIZATION OF A CLASS OF CONSTRAINED FUZZY SYSTEMS: A POSITIVE INVARIANCE APPROACH

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**ABSTRACT.** *This paper deals with the extension of the positive invariance approach to Takagi-Sugeno fuzzy systems. The saturations on the control are taken into account during the design phase. This attempt is firstly applied to a class of fuzzy systems. Sufficient conditions of asymptotic stability are given ensuring in the same time that the global control is always admissible inside a common polyhedral set.*

**Keywords:** Fuzzy systems, Constrained control, Positive invariance

**1. Notation.** For two vectors  $x, y \in \mathbb{R}^n$ ,  $x \preceq y$  if  $x_i \leq y_i$ ,  $i = 1, \dots, n$ . For a matrix  $H \in \mathbb{R}^{n \times n}$ ,

$$h_{ij}^+ = \max(h_{ij}, 0), \quad h_{ij}^- = \max(-h_{ij}, 0),$$

for  $i, j = 1, \dots, n$ , where  $h_{ij}$  denotes the matrix component  $H(i, j)$ . We also note  $\lambda_i(H)$  the  $i$ th eigenvalue of a matrix  $H$ , and  $\sigma(H) = \{\lambda_i(H) \mid i = 1, \dots, n\}$ .  $P > 0$  stands for a positive definite matrix  $P$ .

**2. Introduction.** An interesting way to approach a large type of non linear systems is to consider its representation by a Takagi-Sugeno (TS) type fuzzy model. Indeed, in this representation, by a qualitative knowledge of the system, local dynamics in different state space regions are represented by linear models. Due to its practical importance, this approach has been an area of extensive research for many years [11]-[14] leading to different applications on nonlinear systems [7]-[9]. In fact, most realistic plant in the industry involves some type of specification as non symmetrical saturation on the control. These limitations which are generally modeled by constraints of inequality type can degrade