



## New Stability Conditions for TS Fuzzy Continuous Nonlinear Models

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**Abstract:** Several linear and nonlinear fuzzy models stability conditions are developed in the literature. Some of them concern the linear fuzzy Takagi–Sugeno (TS) model and are based on the determination of a common positive definite matrix, solution of linear matrix inequalities.

A new explicit formulation of stability conditions and an extension to the case of nonlinear TS fuzzy continuous models are given in this paper.

The proposed criteria are based on the use of the vector norm approach associated, in the state space description, to a specific characteristic matrix form, called arrow form matrix. This representation is such that only the elements of the diagonal, those of the last row and those of the last column can be different from zero.

The obtained stability conditions, explicitly expressed by the studied models and fuzzification parameters, applicable for TS fuzzy models in particular, make the approach useful for the synthesis of stabilizing fuzzy control law.

For a class of considered Lur'e–Postnikov continuous case, the stability criterion corresponds to a simple condition on the instantaneous characteristic polynomial of the nonlinear studied system.

**Keywords:** *Nonlinear continuous system; TS fuzzy model; stability; arrow form matrix; vector norm; Lur'e–Postnikov system.*

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