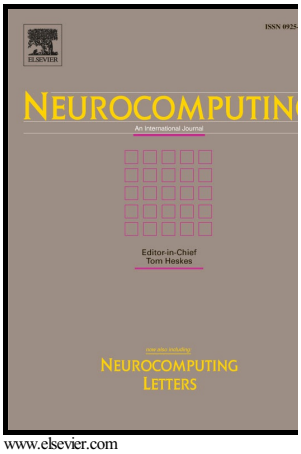




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Congjiang Wang, Shaosheng Zhou, Yangyang Kong

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# State feedback control of interval type-2 T–S model based uncertain stochastic systems with unmatched premises ☆

Congjiang Wang[a,b], Shaosheng Zhou[a,*], Yangyang Kong[a]

[a]*Institute of Information and Control, School of Automation, Hangzhou Dianzi University, Hangzhou, Zhejiang 310018, PR China*
[b]*School of Science, Hangzhou Dianzi University, Hangzhou, Zhejiang 310018, PR China*

**Abstract**

This paper is concerned with the state feedback control for interval type-2 (IT2) uncertain Itô stochastic fuzzy systems with a multidimensional Wiener process and unmatched premises. The uncertainties are of linear fractional form, and appear not only in the membership functions but also in the parametric matrices of the systems. The fuzzy basis functions of the controllers to be designed are different from those of the IT2 fuzzy model. Since stochastic perturbations and unmatched premises as well as parametric uncertainties are involved in the underlying systems, the stabilization problem becomes more complicated and challenging than that for deterministic systems. Facilitating by space decomposition, the lower and upper membership functions (LUMFs) can be locally represented in terms of the convex combinations of some local basis functions whose coefficients can be obtained via evaluating them at the boundaries of the subspaces decomposed. So the unmatched fuzzy basis functions can be handled in stability analysis of the resulting closed-loop systems with support of these local representations. Then by employing a matrix decomposition technique which is effective in dealing with linear fractional uncertainties which involve a multidimensional Wiener process, a state feedback controller is developed such that the resulting closed-loop IT2 system is stochastically asymptotically stable. Finally, a simulation example is given to demonstrate the effectiveness of the proposed method.



*Keywords:* Interval Type-2 Fuzzy System, Stochastic System, Unmatched Premises, Parametric Uncertainty

## 1. Introduction

In the past few decades, type-1 Tagaki–Sugeno (T–S) fuzzy systems have been investigated, see [1–5] and references therein. The main motivation of T–S models should be attributed to their approximation capabilities which can represent complex nonlinear systems by a set of local linear systems. However, type-1 fuzzy systems are not able to directly handle uncertainties of the membership functions. Based on the type-2 fuzzy sets, type-2 fuzzy models were

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*Corresponding author

*Email addresses:* congjiangw@163.com (Congjiang Wang), sszhou65@163.com (Shaosheng Zhou), miler1122@163.com (Yangyang Kong)