Nonlinear Dynamics and Systems Theory, **19** (2) (2019) 217–226

# Optimal Voltage Controller using T-S Fuzzy Model for Multimachine Power Systems

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Received: January 10, 2019; Revised: May 15, 2019

**Abstract:** This paper presents an LMI approach to optimal fuzzy control based on the quadratic performance function to enhance the transient stability and achieve voltage regulation for multimachine power systems. First, the dynamic model of the power system has been modeled by Takagi-Sugeno fuzzy systems using the method of sum of products of linearly independent functions. The optimal fuzzy controller proposed is designed by solving the minimization problem that minimizes the upper bound of a given quadratic performance function. The stability conditions are represented in terms of LMIs. The proposed controller is applied to a two-machine three-bus power system. Simulation results illustrate the performance of the developed approach regardless of the system operating conditions.

**Keywords:** *multimachine power system; T-S fuzzy model; optimal fuzzy control; Lyapunov stability; linear matrix inequalities (LMI).*

**Mathematics Subject Classification (2010):** 03B52, 93C42, 94D05.

## 1 Introduction

System stability is the most important issue for power systems; traditionally, transient and voltage instability have been the most widespread stability problems. They concern the maintenance of the synchronism between generators as well as a steady acceptable voltage under normal operating and disturbed conditions.

Modern power systems are highly complex and nonlinear, and their operating conditions can vary over a wide range, therefore, the nonlinear characteristics of the power system and, hence, the nonlinear dynamic model of the system should be used in the analysis of transient stability and voltage regulation.

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