

FUZZY GUARANTEED COST TRACKING CONTROL FOR BOILER-TURBINES VIA TS FUZZY MODEL

JIE WU¹, SING KIONG NGUANG², JIONG SHEN^{1,*}, GUANGYU JUSTIN LIU³
AND YI GUO LI¹

¹School of Energy and Environment
Southeast University
Nanjing, P. R. China
jiewu7@gmail.com; lyg@seu.edu.cn

*Corresponding author: shenj@seu.edu.cn

²Department of Electrical and Computer Engineering

³Department of Mechanical Engineering
University of Auckland
Auckland 1010, New Zealand
{ sk.nguang; g.liu }@auckland.ac.nz

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ABSTRACT. *This paper addresses the problem of designing a fuzzy guaranteed cost state feedback tracking control for a boiler-turbine. First, the Takagi and Sugeno fuzzy model is employed to represent a boiler-turbine system. Next, based on the fuzzy model, a sufficient condition for the existence of a fuzzy guaranteed cost nonlinear state feedback tracking control is derived in terms of linear matrix inequalities. The advantage of the proposed tracking control design is that only a simple fuzzy controller is constructed and it does neither involve the feedback linearization technique nor complicated adaptive scheme. Numerical simulations of a boiler-turbine system are given to illustrate the effectiveness of the proposed design as compared with a linearized approach.*

Keywords: Fuzzy, Guaranteed cost, Tracking, Boiler-turbines system

1. Introduction. A boiler-turbine system is an energy conversion device which consists of steam boiler and turbine. The aim of a steam boiler is to transfer the input chemical energy of fuel into the thermal energy that is directly fed to a turbine. Nowadays, boiler-turbine systems are the preferred electricity generation systems, as they are able to meet electricity demands much faster than the header systems. The followings are the requirements of a typical boiler-turbine system control problem:

1. Electric power output must meet the load demand.
2. The drum pressure must be maintained within some tolerances despite the load's variations.
3. The water level in the steam drum of the boiler must be maintained at a desired level to prevent overheating or flooding.
4. The steam temperature must be maintained at a desired level to prevent overheating or leaking wet steam to turbines.
5. The constraints of inputs and outputs are imposed by physical limits such as the magnitude and saturation of the internal control valves saturation, magnitude and valves tuning rates must be taken into considerations.