

MODELING AND SIMULATION OF FUZZY LOGIC CONTROLLER-BASED MODEL REFERENCE ADAPTIVE CONTROLLER

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ABSTRACT. *The aim of this paper is to design a Fuzzy Logic Controller-based Model Reference Adaptive Controller. It consists of Fuzzy Logic Controller (FLC) along with a conventional Model Reference Adaptive Control (MRAC) scheme. The idea is to control the plant by conventional MRAC with a suitable single reference model, and at the same time control the plant by FLC. In the conventional MRAC scheme, the controller is designed to realize plant output converges to reference model output based on the plant which is linear. This scheme is for controlling linear plant effectively with unknown parameters. However, using MRAC scheme to control the nonlinear system at real time is difficult. In this paper, it is proposed to incorporate an FLC in MRAC scheme to overcome the problem. The control input is given by the sum of the output of conventional MRAC and the output of FLC. The rules for the FLC are obtained from the conventional PI Controller. The effectiveness of the proposed control scheme is demonstrated by simulations. The proposed Fuzzy Logic Controller-based Model Reference Adaptive Controller (FLC-MRAC) can significantly improve the system's behavior and force the system to follow the reference model and minimize the error between the model and plant output.*

Keywords: Model reference adaptive control (MRAC), Fuzzy logic controller (FLC), Proportional-integral (PI) controller

1. Introduction. Model Reference Adaptive Control (MRAC) is one of the main schemes used in adaptive system. Recently, MRAC has received considerable attention, and many new approaches have been applied to practical processes [1,2]. In the MRAC scheme, the controller is designed to realize plant output converges to reference model output based on the assumption that plant can be linearized. Therefore, this scheme is effective for controlling linear plants with unknown parameters. However, it may not assure for controlling nonlinear plants with unknown structure. It is well known that fuzzy technique has been widely used in many physical and engineering systems, especially for systems with incomplete plant information [3-8]. In addition to fuzzy logic, it has been widely applied to controller designs for nonlinear systems [9-13]. A novel fuzzy model reference based controller for controlling nonlinear plants can be found in [14]. H. Han [15] proposed an adaptive FLC for a class of nonlinear system with disturbance. A problem of Fuzzy-Approximation-Based adaptive control for a class of nonlinear time-delay systems with unknown nonlinearities and strict-feedback structure is discussed in [16]. C.-W. Chen et