International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 12 Dec 2021, pp: 1578-1581 www.ijaem.net ISSN: 2395-5252

Evaluate the Effectiveness of the Hybrid Fuzzy Controller of Disturbance Noise for Dc Motor
Part 2: Evaluate the effectiveness of the hybrid fuzzy controller in controlling the DC motor when the system is affected by disturbance noise

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Date of Submission: 15-12-2021 Revised: 28-12-2021 Date of Acceptance: 31-12-2021

ABSTRACT: In the control of DC motors in production, especially in industry, there are many systems with high requirements for operation, because it greatly determines the quality of products made and the productivity of the system. In fact, there have been many studies on classical controller and fuzzy controller, each controller has its own advantages and disadvantages. This paper will study the hybrid fuzzy controller, which is a controller that combines the advantages of the two classical and fuzzy controllers mentioned above. Specifically, the paper will focus on the problem of evaluating the effectiveness of the hybrid fuzzy controller in speed control for DC motors when disturbance noise affects the system. The paper divide in to 2 parts following:
Part 1: Structure of the hybrid fuzzy controller with the effect of noise on the system.
Part 2: Evaluate the effectiveness of the hybrid fuzzy controller in controlling the DC motor when the system is affected by disturbance noise.

KEYWORDS: Fuzzy, controller, F-PID, DC motor, disturbance noise.

I. INTRODUCTION

In the control field, especially precise control is increasingly demanding. Most industrial machines and household appliances use electric motors. The classic controllers applied to motor control have been studied a lot and have achieved many positive results. However, in modern control, fuzzy controller or hybrid fuzzy controller provides a new controller to improve the quality of classical controller, as well as control unknown or difficult to identify objects.

Many fuzzy logic control schemes used in industrial practice today are based on some simplified fuzzy reasoning methods [1], which are simple but at the expense of losing robustness, missing fuzzy characteristics, and having inconsistent inference[2]. A novel non-Gaussian stochastic control framework for the problem of disturbance estimation and rejection by combining fuzzy identification technology with disturbance observer design [3].The undesirable characteristics of the fuzzy PI controller are caused by integrating operation of the controller, even though the integrator itself is introduced to to overcome steady state error in response [4]. A systematic procedure for constructing a multi-input multi-output fuzzy controller that guarantees identical performance to an existing stabilizing linear controller [5]. A computation of fuzzy modelis applied of fuzzy controllers in a noisy environment which shows in [6]. This paper focus on the problems of evaluating the effectiveness using the hybrid fuzzy controller in speed control for DC motors with disturbance noise affects on the system

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II. STRUCTURE OF THE HYBRID FUZZY CONTROLLER WITH THE EFFECT OF NOISE ON THE SYSTEM

To demonstrate the correct of hybrid fuzzy PID controller structure for the speed stability control problem with the effect of noises. This paper, we do explain more clearly the effectiveness of the hybrid fuzzy PID controller in controlling DC motors by comparing simulation results between classical PID controllers (specifically, the P controller with controller parameter P is Kp= 25) and hybrid fuzzy PID controller have been proposed for speed loop in the problem of stable control of DC motor speed (controller parameters PI are K_p = 32.5 and K_I = 1.5). Especially to effectively highlight the hybrid fuzzy PID controller in the presence of noise. We give the parameters of noise acting on the motor shaft with the sine input setting. The assumption in the simulation with noise has the following sinusoidal input: . Therefore, we adopted a simulation diagram for the DC motor speed control system as shown in the Figure 1 as following.

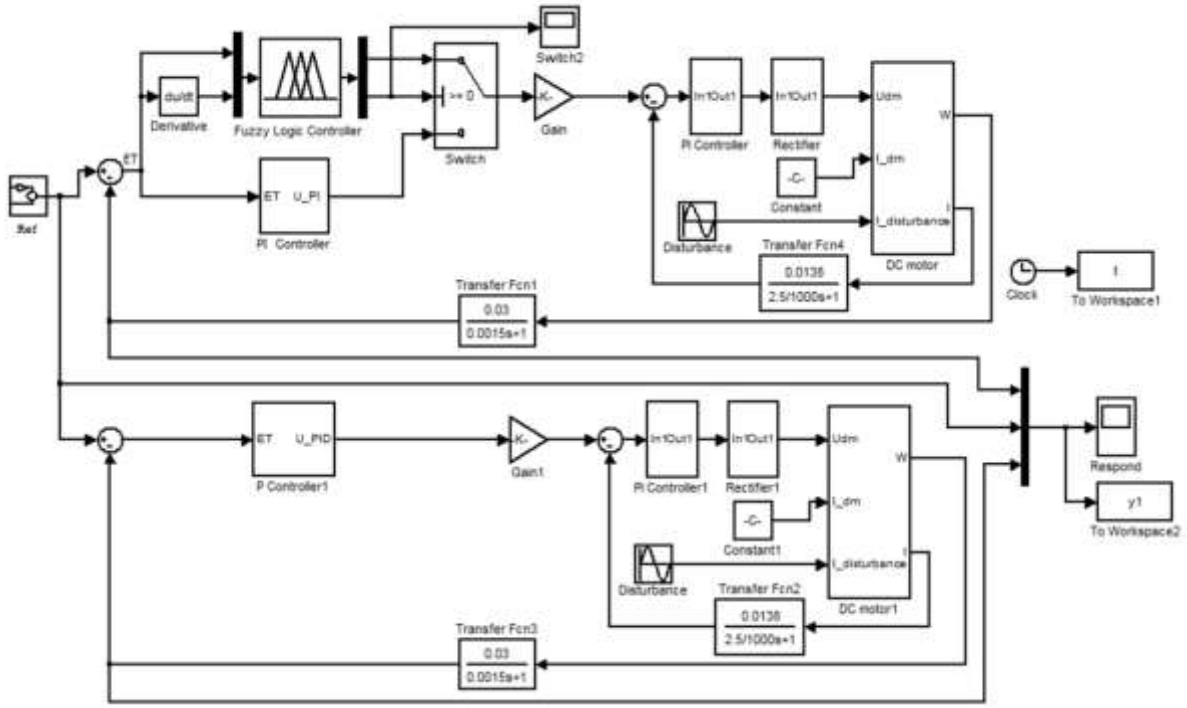

Figure 1: Simulation of P-controller and hybrid fuzzy PID controller for DC motor speed loop control with stabilization in the presence of noise

In the simulation structure diagram, several different types of input are given to evaluate the effectiveness of the proposed controller.

-With Step function as the input of the system

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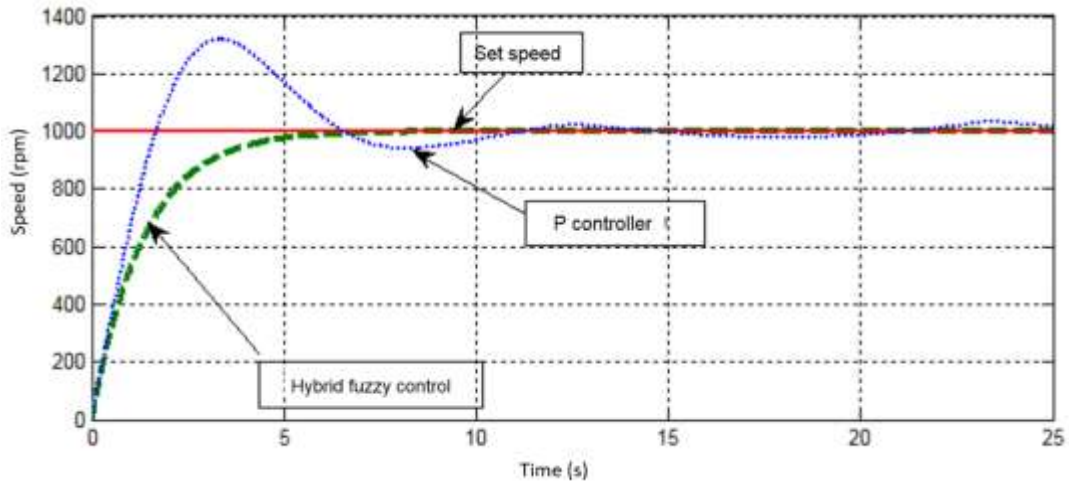

Figure 2: Comparison of the response between the P controller and the hybrid fuzzy PID controller of the speed loop without noise effected

- With Square function as the input of the system:

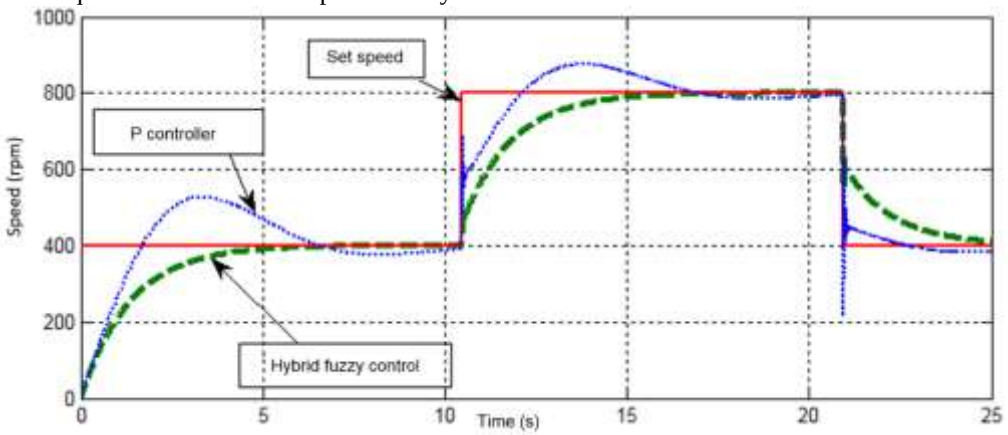

Figure 3: Comparison of the response between the P controller and the hybrid fuzzy PID controller of the speed loop with noise effected

The response of simulation resuts denotes the quality of the over all system of using the proposed hybrid fuzzy PID controller given the better response than the P controller which shown in the Figure 2 and Figure 3 as well.

III. CONCLUSION

The hybrid fuzzy PID controller structure and calculation have been adopted in the part 1 of the paper. In this part 2, we go to evaluate the simulation results obtained for the system with some of different input cases of noise effected. It shows that when the DC motor is affected by noise, the response of the hybrid fuzzy PID controller proposed for the speed loop circuit has superior control quality compared to the P controller as well. The response of the P controller shows of instability with changing the amplitude of the noise affected. The motor shaft dynamics increase, while the hybrid dimming response remains accurate to the setting value.

ACKNOWLEDGEMENTS

This research was supported by Research Foundation funded by Thai Nguyen University of Technology

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