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INTERVAL TYPE 2 FUZZY GAIN-ADAPTIVE PI CONTROLLER OF BRUSHLESS DC MOTOR

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ABSTRACT

This paper presents a comparison between an Interval Type 2 Fuzzy Gain Adaptive PI and a Conventional PI controllers used for speed control of an Electronically Commutated Motor (BrushLess DC Motor). In particular, the introduction of this paper presents a type 2 fuzzy logic Gain Adaptive PI controller of machines, in the first part we presents a description of the mathematical model of BLDCM, and an strategy method is proposed for the speed control of this motor in the presence of the variations parametric, A interval type-2 fuzzy inference system is used to adjust in real-time the controller gains. The obtained results show the efficacy of the proposed method.

Keywords: *ECM, BLDCM, IT2FGAPI, Interval Type-2 Fuzzy Gain Adaptive PI, BrushLess DC*

INTRODUCTION

Modern drive technology requires more and more precise and continuous control of speed, torque and position, while ensuring the highest stability, speed and efficiency possible. The DC motor has satisfied some of these requirements but it is provided with brushes rubbing on the collectors, which limits the power and the maximum speed and presents difficulties of the maintenance and interruptions of operation. For all these reasons, the research is moving towards a better exploitation of robust actuators, with improved characteristics, the DC motors have been gradually replaced by the BLDC motors. The BLDC motor has the low inertia, large power to volume ratio, and low noise as compared with the permanent magnet DC servo motor having the same output rating [1-3]. The special feature of the BLDC machine is the stator is equipped with sensors that detect the position of the rotor to control the electronics that ensures the switching of the currents in the phases. Hall Effect sensors are mainly encountered, but optical devices are also used. The BLDC motor is found in different applications such as electric and hybrid vehicles, spacecraft, aeronautics, robotics, space mission tools, factory automation and the field of robotics…etc[4-6]. The control strategy based on PI gain scheduling, a number of methods have been proposed in the literature for PID gain scheduling [7] a stable gain-scheduling PID controller is developed based on grid point concept for nonlinear systems. Different gain scheduling methods were studied and compared [8, 9], a new PID scheme is proposed in which the controller gains were scheduled by a fuzzy inference scheme. Many method and research works in this domain in [10-13], the author in [14] Optimized the Fuzzy System by Genetic Algorithm for the gains Adaptive PI Controller of Induction Motor Control, the type 1 Fuzzy Gain Adaptive PI of BLDCM in [15], Adaptive Fuzzy Gain Scheduling of PI Controller for control of the Wind Energy Conversion Systems in [16] The interested readers can find a brief review of different fuzzy PID structures in [17]. The present work deals with an IT2FGAPI Controller method for controlling the speed of BLDCM.

The remainder of this paper is organized as follows. In section I, the model of three-phase BLDCM Section II develops the dynamic model. Section III is devoted to the PI gain adaptive control based on the interval type-2 fuzzy logic. The simulation results to demonstrate the effectiveness of the proposed approach is presented in Section IV.

THEORY

The model simplified of the BLDCM is shown in figure 1:

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