ABSTRACT

Brushless DC (BLDC) motors are widely used for many industrial applications because of their high efficiency, high torque and low volume. In view of the problem that the current control method of speed regulation system of BLDC motor has poor control effect caused by fixed parameters of PID controller, an adaptive PID algorithm with quadratic single neuron (QSN) was designed. Quadratic performance index was introduced in adjustment of weight coefficients; expected optimization effect was gotten by calculating control law. QSN adaptive PID controller can change its parameters online when operating conditions are changed, it can also change its control characteristic automatically. Matlab simulations and experiment results showed that the proposed approach has less overshoot, faster response, stronger ability of anti-disturbance, the results also showed more effectiveness and efficiency than the conventional PID model in motor speed control.

Keywords: Adaptive PID Algorithm, Brushless DC Motor (BLDC Motor), Quadratic Performance Index, Quadratic Single Neuron (QSN), Speed Response

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INTRODUCTION

Brushless DC (BLDC) motor has a series of advantages such as simple structure, high reliability, convenient maintenance, high efficiency, no excitation loss and so on. So far, BLDC motor has been widely used in aerospace, CNC machine tools, electrical equipment, mining and other fields. For BLDC motor the controller plays a very vital role in influencing its performance for applications concerning load variations (Krishnan, R. 2010; Chau, K. T., Chan, C. C., & Liu, C. 2008; Liao, L. Y., Wang, Z. F., Deng, Y. D., & Hu, X. L. 2003).

The proportional-integral-derivative (PID) controller is widely used in many control applications because of its simplicity and effectiveness, but there are some limitations in conventional PID algorithm because PID controller tuning parameter is fixed, however BLDC motor control system is a multi-variable, nonlinear, strong coupling system, therefore the PID control parameters need to be adjusted according to actual situation. Due to changes in the external disturbance by the system parameters, it is difficult to achieve the best control effect. Therefore, control strategy of high performance electrical drives must be adaptive and robust. As a result, interest in emerging intelligent control systems for electrical drives has increased significantly and numerous intelligent control schemes for BLDC motors are projected.


This paper presents a quadratic single neuron (QSN) adaptive PID control algorithm, quadratic performance index is introduced in adjustment of the weight coefficients of the
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