Speed Control of Brushless DC Motor Based on PID and Wavelet Neural Networks

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By

Ameer Lateef Saleh

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Abstract

Brushless DC motors (BLDC) have a wide applications in industries due to their high power density and high dynamic response. In addition, the BLDC motor is used with constant loads, varying loads and position applications with high accuracy. This motor is generally controlled using electronically commutation by three phase power semiconductor bridge inverter with rotor position sensors which are required for starting and providing proper firing sequence to turn on the power devices in the inverter bridge. Based on the rotor position, the power devices are commutated sequentially every 60 degrees. This thesis presents a mathematical model and the Simulink model of BLDC motor to control the speed of a BLDC by using conventional PID and fractional order PID controller. The DC-DC converter technique is used to control the speed of the motor.

In the past decade, artificial intelligence techniques such as neural networks, fuzzy-neural networks and wavelet neural networks control have been applied to control the speed of the BLDC motor. Due to BLDC motor is a multivariable and nonlinear system, such as the nonlinearity of armature reaction, etc.., it is not easy to obtain a good performance by applying conventional PID control. The main objective of this thesis is develop the wavelet neural networks(WNNs) to control the speed of the motor. The recurrent wavelet neural network(RWNN) and dynamic wavelet neural network(DWNN) are proposed. These methods lead to an improved dynamic behavior of the motor drive system and an immune to load perturbations. The learning strategy for the wavelet neural network and PID controller is developed based on particle swarm optimization (PSO) algorithm.