Department of Electrical Engineering

Delhi Technological University

(Formerly Delhi College of Engineering)

CERTIFICATE

This is to certify that the project entitled, "**INVESTIGATIONS ON HYBRID FUZZY PI CONTROLLERS FOR BLDC MACHINES**", submitted by **Ms. Renu Bhardwaj**, University Roll No. 07/C&I/2010, student of Master of Technology (Control and Instrumentation) in Electrical Engineering department from Delhi Technological University (Formerly Delhi college of Engineering), is a dissertation work carried out by her under my guidance during session 2011-2012 towards the partial fulfillment of the requirements for the award of the degree of Master of Technology in Control & Instrumentation.

I wish her all the best in her endeavors.

Date: July 2012

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ABSTRACT

The permanent magnet brushless DC motor (PMBLDCM) is widely used in many industrial and domestic applications such as hybrid vehicles, consumer appliances, medical equipments, automation industries and robotics applications. With the advancement in the power electronics, integrated circuits, microcontrollers and embedded system a huge demand is created for application specific intelligent portable devices for control. The area of motor drives is also witnessing an increased attention focused especially on cost effective embedded intelligent control.

Hardware requirements for implementation of intelligent control strategy like fuzzy logic, neural network, neuro-fuzzy and genetic algorithm are stringent. Digital signal processors (DSP) or fast microcontroller are capable of fast computation and are generally being employed. Embedded system implementations using microcontroller and DSP or field programmable array (FPGA) or application specific integrated circuit (ASIC) presents a good alternative. These techniques have to be applied with limitations of low computing power and memory availability. So, a control code optimization with different measures is needed to be done for embedded system development.

The thesis deals with speed control of PMBLDC motor drive using various controllers to ascertain their relative performance with different applications. The conventional PI and non conventional fuzzy logic controller (FLC) are investigated primarily and later hybrid controller reaping the benefits of PI and FLC and avoiding the shortcoming of both is proposed in two configurations. Series hybrid in which FLC work as a precompensator for modifying reference speed and Parallel hybrid in which FLC tunes the gains of PI controller is presented for speed control of PMBLDC motor. After ascertaining the benefits of hybrid controller focus was done to reduce the size and computation requirements typically in terms of rules used in FLC. Reduced rule base hybrid controller is also developed and simulated both the configurations. The reduction in term of applicable size of the code and complexity is achieved. The modeling and simulation of these speed controllers is done on MATLAB/Simulink environment for PMBLDCM drive. The performance comparison is done based in terms of several performance measures under all operating conditions.

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