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DESIGNING OF BLDC MOTOR CONTROLLER FOR ELECTRIC VEHICLES

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Abstract- Permanent magnet brushless DC motors (PMBLDC) find wide applications in industries due to their high power density and ease of control. These motors are generally controlled using a three-phase power semiconductor bridge. For starting and providing proper commutation sequence to turn on the power devices in the inverter bridge the rotor position sensors are required. Based on the rotor position, the power devices are commutated. This thesis presents a Fuzzy Logic Controller (FLC) or speed control of a BLDC by using. The Fuzzy Logic (FL) approach applied to speed control leads to improved dynamic behavior of the motor drive system and an immune to load perturbations and parameter variations. The FLC is designed using based on a simple analogy between the control surfaces of the FLC and a given Proportional-Integral controller (PIC) for the same application. Fuzzy logic control offers an improvement in the quality of the speed response, compared to PI control. This work focuses on the investigation and evaluation of the performance of a permanent magnet brushless DC motor (PMBLDC) drive, controlled by PI, and Fuzzy logic speed controllers. The Controllers are for the PMBLDC motor drive simulated using the MATLAB software package. Further, the PI controller has been implemented on an experimental BLDC motor setup.

Keyword— Brushless DC Motor (BLDC), Inverter, PID Controller, the Fuzzy Logic Controller (FLC), Closed-Loop Speed Control

I. INTRODUCTION

Brushless dc (BLDC) motors are preferred as small horsepower control motors due to their high efficiency, silent operation, compact form, reliability, and low maintenance. However, problems are encountered in these motors for variable speed operation over the last decades. Continuing technology development in power semiconductors, microprocessors, adjustable speed drivers control schemes, and permanent-magnet brushless electric motor production have been combined to enable reliable, cost-effective solutions for a broad range of adjustable speed applications. The rotational voltage (back EMF) created determines whether a BLDC motor is sinusoidal (PMSM)or trapezoidal (PM BLDC). These motors, classified as special electrical motors, are considerably more appropriate for efficient drive operation due to recent technological breakthroughs.

II. DISCUSSION

A. Based on sensors

[1] Compared with the conventional direct Torque control with PID controller, and thus their results are compared with Artificial Neural Network for checking the stability of control systems operations. This operation is satisfied and verified using MATLAB. Using DTC, they have estimated the torque and flux of the motor by measuring the current of the engine the derived values of torque and change will be compared with the reference value, using DTC is a good way as it is one of the forms of hysteresis and the optimization of the DTC is done through the PI controller in DTC system, which gives the optimum operations. Thus, using DTC of sensor-less BLDC and artificial Neural Network developed with optimized switching table voltage vectors

[2] In this paper, the design code generation and digital logic control were built for BLDC motor controller for tuning the rotor clockwise or anticlockwise the speed is adjusted through the pulse with modulation speed control strategy and thus shows the implementation of code generation, circuit design, and stimulate the test results ofBLDC controller, the Potentiometer, the Microcontroller, the driver, the MOSFET, hall sensor and BLDC motor were designed and constructed. The operation of channel separation is applied on the watermarked color image to generate its sub-images, and then a 2-level discrete wavelet transform is applied on the sub-images to generate the approximate coefficients and detail coefficients.

[3] Implemented the Type-2 Fuzzy logic as they are more able to reduce uncertainty effects in rule-based fuzzy systems, also they have implemented proportional integral derivative (PID)controller for speed control of BLDC motor, As the Fuzzy controller process is too complex conventional control methods and cannot be effectively controlled so to overhead these problems adaptive PID controller and automatic adjust methods are developed. Thus, the adjustments of PID gains through Fuzzy logic are proposed by considering the Type -2 Fuzzy-based self-tuning PID controller and showing a better-quality performance

[4] In this paper, For the regulation of Unmanned aerial vehicles(VAVs), the sensorless controller is introduced and designed, the comparison of the usual motor control architecture was presented namely the Field oriented controland Brushless DC (BLDC) control. It focuses attention to the typical back electromotive force. A recently proposed system observer integrated into a nested FOC Architecture including with low computational effort and formal stability. It makes the resulting strategy suitable for implementation in embedded computing systems. The benefits of FOL over BLDC control are shown and resulting in higher efficiency and longer flight duration. The sensorless controller was presented to achieve high performance with a lower complexity in aggressive speed reference cracking. The controller depends on correct implementation on accurate knowledge of stator resistance and inductance. In future works they have added the information to be supplied online with adaptive and system identification techniques. The unmannered aerial vehicle will need to address this aspect in the coming years to meet the ever-growing performance and robustness requirements.

[5] Developed a new technique named Particle swarm Optimization (PSO) has developed for controlling speed of BLDC motor and to find the parameters for the PI controllers such as Kp and Ki and thus powered by a solar PV array which was the MPPT technology to extract optimum efficiency here the MPPT is implemented to maximize the power. From this paper dealing with controlling BLDC motor speed through PSO fed from a solar array proposed from the following Parameters such as a solar array, PI controller, converter, 3D Inverter here, the PSO finds the mostoptimized result for the PI controller to control rotor speed.

[6] Fuzzy controller is approached and the speed control of the BLDC motor is achieved by controller. Conventional PI controller can be replaced by Fuzzy logic controller due to its condition of Nonlinearity. Permanent magnet BLDC motor Fuzzy controller and Fuzzy rules were built up and constructed by comparing the speed of the BLDC motor to the reference value, the speed control of the BLDC motor to the reference value the speed control of the BLDC motor is achieved with the help of Fuzzy logic and Fuzzy theory the output can be obtained and the performance were monitored and thus compared with the conventional PI controller, fuzzy controller shows the betterresponsible which proved through the comparative-study.

[7] The BLDC motor is designed and developed and get compared with the existing BLDC motor on a performance basis. A detailed description was taken and the controllers were tested and experimented. The Reductionof power consumption and noise control were achieved in this paper and the performance was analyzed. The stimulation of the BLDC motor is done using Proteus simulation software and the PCB is simulated in AREAS

[8] Proposed a new algorithm called flower pollination for the controller to control the speed of BLDC motor This algorithm is applied to the PID controller to control the speed and reduced in time. A detailed study of the BLDC motor speed control has been taken and its performance is monitored the better performance was deserved in FPA based speed controller when compared with basic PID controller. When changing the motor speed and the torque. Thesuggested system has been reduced overshoot the model stimulation were carried out by the MATLAB.

[9] They have designed a Robust controller of permanent magnet synchronous motor (PMSM) AND estimate the uncertainties and disturbances from the produced output. These are estimated using an observer (DO) for a disturbance occurring in the servo system. The nonlinear PMSM model is linearized using Jacobian linearization around an operational point, and a state feedback

controller with an Integral turn is built at this point. Do use to updatethis operational point. Proposed system validated on MATLAB Simulink.

[10] In this paper the sliding motor control scheme was implemented to improve the dynamic behaviour of BLDC motor, the sliding mode scheme was used certain algorithms were built to cascaded sliding mode controllers taken into account the exponential making of low calculations were proposed for the inner loop current control and for outerloop speed control of the drive the main advantage of the proposed voltage controller is to minimize overshoot the control voltage at the startup of the converter. The Two controllers were demonstrated one controller is used for current loop and the other controller is used for speed loop of BLDC motor. The cuckoo search algorithm is utilized for tuning the parameters of sliding mode controllers. The optimized solution can be obtained by cuckoo search algorithm the performance of the sliding mode controllers were monitored and compared with PID and Fuzzy such asPID Controller. The output is verified through the MATLAB simulations.

IV.CONCLUSION

A fuzzy logic controller (FLC) has been employed for the speed control of the PMBLDC motor drive and analysis of results of the performance of a fuzzy controller is presented.The modeling and simulation of the complete drive system are described in this proposal. The effectiveness of the model is established by performance prediction over a wide range of operating conditions. A performance comparison between the fuzzy logic controller and the conventional PI controller has been carried out by simulation runs confirming the validity and superiority of the fuzzy logic controller forimplementing the fuzzy logic controller to be adjusted such that manual tuning time of the classical controller is significantly reduced. The performance of the PMBLDCM drive concerning PI controller, FLCcontroller, and experimental verified with a conventional PI controller using DSP processor. The fuzzy logic speed controller improved the performance of PMBLDC Drive of the fuzzy logic speed controller.

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