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Power optimization of induction motor using fuzzy logic Control for EV(electric Vehicles)

B.Sandeep Patnaik [a], M.Balaji [a] , P.Sandeep [a], D.Vijay [a], M.Dilip Kumar [a]

Dept.of EEE, MLR Institute of Technology, Hyderabad,India.

Abstract

Electric powered vehicles (EV's) and hybrid EV's is the next gen mobility ,Performance is a very crucial part where power capacity is restricted. Adding to its excessive balance and occasional price, To improve more efficiency and reduce the losses the induction motor is the best choice. This draws more power than the required when compared to maximum load. This made us to propose a method to control motor primariliy based on the fuzzy logic manipulate for EV programs. This controller can enhance the starting cutting-edge amplitude and saves extra energy. Through the Simulation software like MATLAB/Simulink the overall performance of the system is manipulated and tested using the software. When compared to the traditional proportional imperative derivative controller, the schemes shows us the results and high-overall performance values in time-domain reaction and the fast rejection of device leads to disturbances. Thus the losses of the induction motor are substantially decreased, with this it improves the performance of the running device. The device is validated by means of the experimental situations obtained within the lab, Thus simulation outcomes are good.

Keywords: EV drive , Induction Motor , Fuzzy Logic Control.

1. Introduction

In last few decades, The usage of fuels increased a lot which led to increase in concentration of co2 in the atmosphere. Concerns approximately weather alternate and growing sea tiers as a result of international rise in temperature are becoming a big issue and looking for a way to reduce co2. A giant development within the fuel performance of automobiles is vital, because the production units emit 25% of total carbon dioxide emissions. Electric cars (EV's) have a lot of benefits because they are green, environment friendly, quiet, and commonly lesser power dependence than the selection of the electrical system. This leads to reduce the performance and the force available. But, machines are the main source for an force which include people who may be using EV's and hybrid EV's. The synchronous vehicles and induction automobiles (IMS) are the primary set of machines that can be used in Electric vehicles. The motor used to run the electric vehicle should have the characteristics of below.

(i) High torque for better driving feel;
(ii) Efficient for driving and increate speed, range.

2. Theoretical Analysis

In this, An FLC-based method is proposed for electric vehicles. A contrast among each of the controllers (PID and FLC) is then supplied based on their impact on IM performance. The principle contributions because of this paintings can

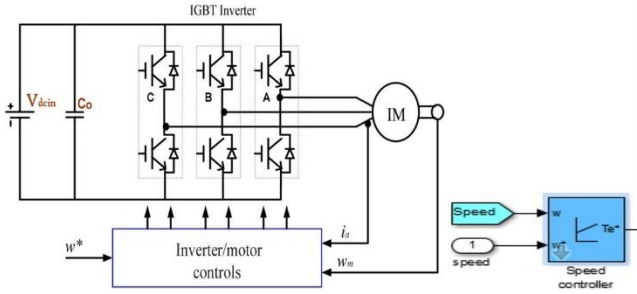

Figure 1 *EV drive with an IM*

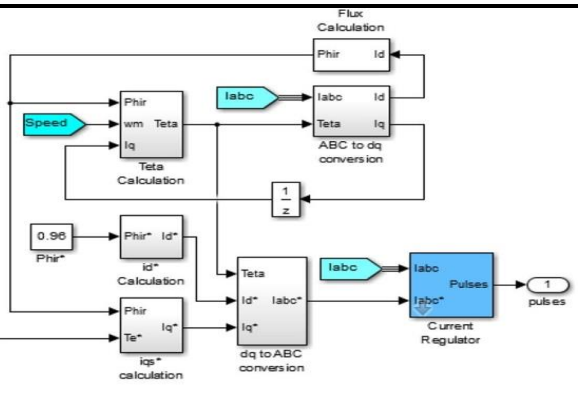

Figure 2 *Control system of IM*

The primary thing is reducing the value the drive cycle, at desired speeds and higher, and efficiency and the main strength. The performance of the inverter will suffer from the complete performance.

3 Control principle

3.1 Traditional PID control

A PID controller is added in the circuit. In order to manipulate the velocity we have orientated Induction motor. From the figure 2 we can observe the conversion equations and a section which sets the rules and also gives the regulations. The conversion is taken place for currents. We can find the more additives of d and q by the below formulae.

Sin(ωt) sin ωt − 223ππ cossin ωtωt++ 2233ππ × iiisasbsc (1) cos(ωt) cos ωt − three

The live and reactive energy calculated now consists of oscillation and common additives. However, The outer PID loops are utilised to gather the common components of the outputs .The active strength and reactive electricity. A block diagram of the conventional PID manipulate is given in fig.3 . This PID produces

active current reference (id*) and reactive modern-day reference (iq*), as given within the following conversions:

Id∗ = kp(pref − p) + ki∫ (pref − p)dt (2)

Iq∗ = kp(qref − q) + ki∫ (qref − q)dt (three)

Where kp = proportional steady and ki = simple constant. Pref = the energy reference and Qref = reference fee of the reactive power. The circuit is designed using the loop. While comparing with actual and current. Thus we can change the loops.

While the non-linear movements of the motors, the main SCIM controlling this hassle stays a tough hassle due to the fact many elements range with the real time conditions. The considerations of the design are Using fuzzy rules in specific locations, choosing the features and adjusting, deciding on scaling elements.

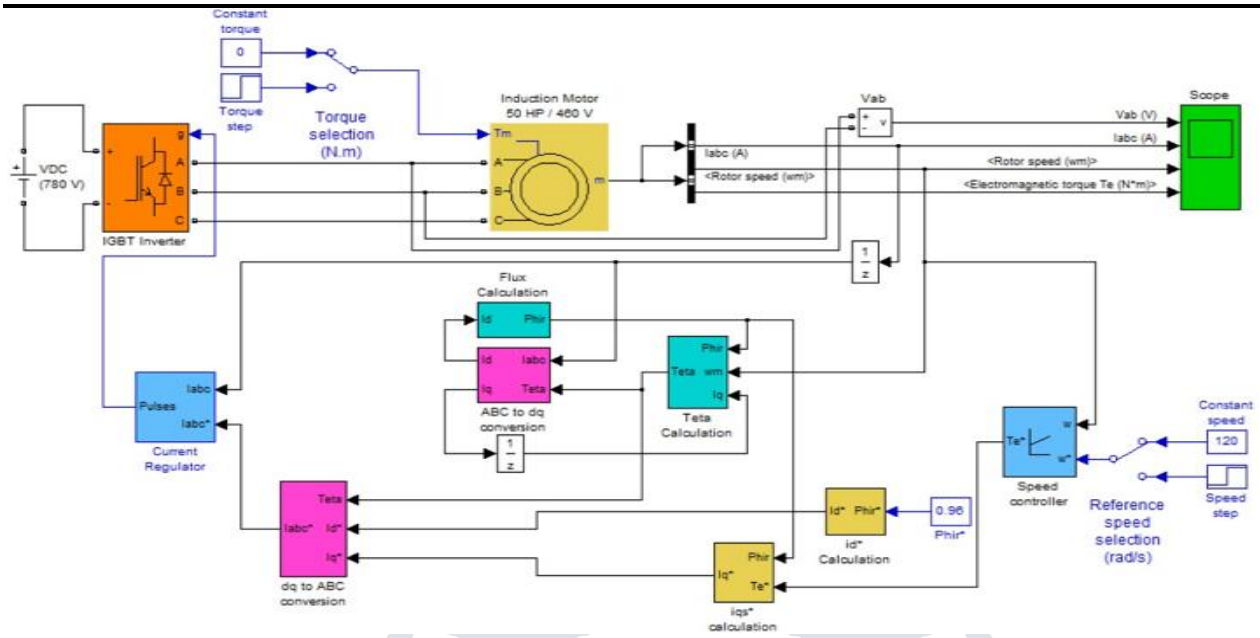

Figure 3 *model of three-phase IM for matlab*

Calculation of efficiency and power losses in IMD

The losses of this are at full load. This is the max test we can run and the outputs are mentioned

Pag = pin − (percent + pcore) = *P*Conv + *P*RCL = 3*I*22*RS*2 = *P*RCL*S*

4. Results and Discussions

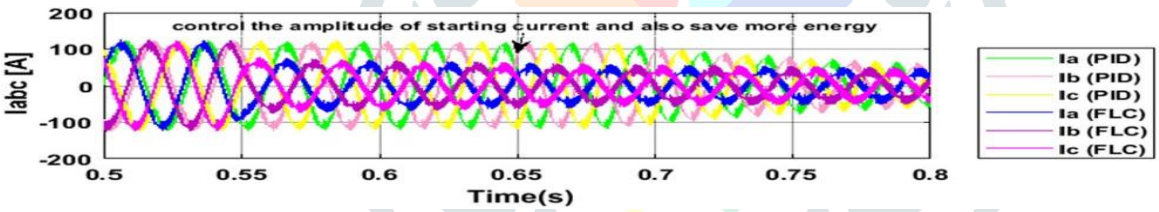

Figure 4 *Three-segment stator present day of PID and FLC fashions*

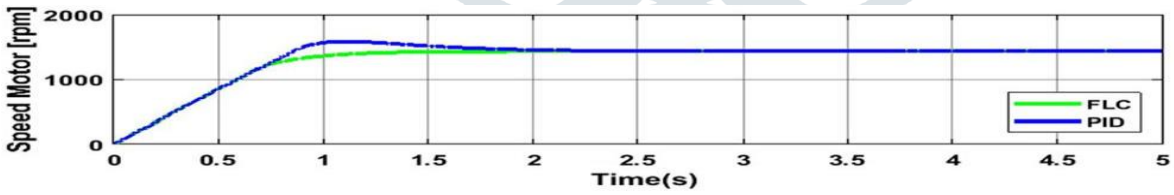

Figure 5 *Pace reaction evaluation between PID and FLC whilst the guidence pace is 1432 rpm*

Using the simulation software as mentioned earlier is used which are taken into consideration as proven in figure 8.
The results which we get from the above diagrams, the starting currents is important and also the output reaction needs to be improved in acceleration. In today's present scenario the losses should be less.
The execution of the simulations are done for both the models to control the induction motor. The output of the control unit can we checked in detail. The assessment shows the overall performance of both models. In terms of all the various aspects.

When both the models are compared then the various speed input gives a quicker reaction in each settling time and upward thrust time. Thus we can say that FLC has higher performance. Also It has a better capability to change the rate of the segment.

The reaction of FLC for selected rpm and its outcomes at some point in load disturbances are shown.
The outputs for an average of 25 simulations. In this way the vehicles reached 9kw in 0.6s and when time is 12s the brakes are applied to72%. This activates the motor to send the energy generated while applying brake to the battery and recharge the battery.

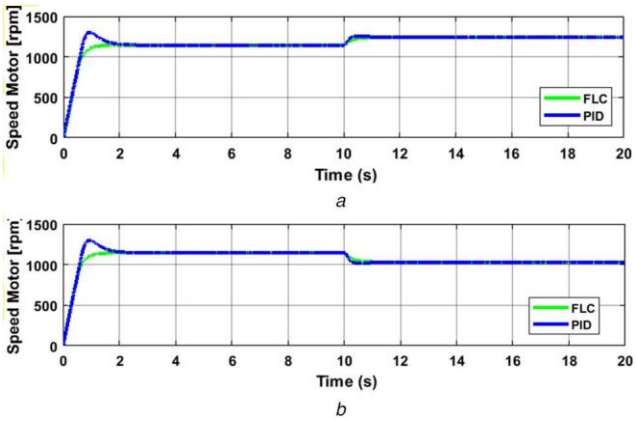

Figure 6 *Response comparison for PID and FLC*

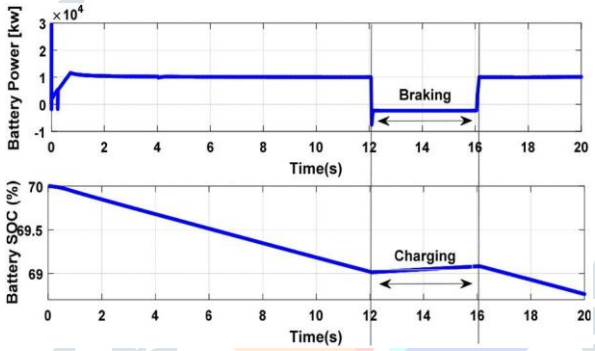

Figure 7 *Battery performance while charging and discharging*

5. Conclusion

With the above experimentation we can conclude that when an induction motor runs in the nominal power or in less load. Then it consumes more power than needed. The extra energy consumed will generate heat. The inputs given to the controller are the errors generated which running or in the beginning of the time period. In this the simulation is conduction on a 50 horse power induction motor driven electric vehicle. With this the overall performance signs are tested inclusive of peak overshoot, regular-state blunders, upward push time, and settling time. The outcomes confirmed that the section present day inside the recommended machine includes less loss. The loss of amplitude are decreased for real torque insdie the region. This gives us the torque with no errors and higher performance than the PID controller in all the aspects. The proposed design of the circuit is shown with the results which gives the best outcomes similar to the real time conditions.

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