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Reactive Power Based Speed Control Of Induction Motor Drive Using Fuzzy Logic For Industrial Applications

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ABSTRACT: The induction motor is basically utilized in many commercial packages because of its numerous houses and its specific variable velocity operation. A type of manage set of rules together with direct torque manage (DTC), discipline oriented manage (FOC) etc. had been industrialized so far; however important precisions are supplementary for higher and efficient velocity manage operations. This paper offers a completely unique reactive energy primarily based totally velocity manage of induction motor power for wide velocity variety packages. This method carries the control of reactive energy curving inside control the device velocity of induction device the usage of fuzzy logic. Expressively this method now no longer handiest recuperates the integration of complicated flux estimators, observers etc. however more importantly the favored energy element operation is obtained. To validate the proposed scheme, the MATLAB simulation and experimental evaluation for 1hp induction device is presented on this paper.

Keywords: FUZZY LOGIC, ARDUINO, LCD, DTC, FOC

1. INTRODUCTION

Induction motor (IM) is frequentlyutilized in industries due to its numerousblessings such as its finer and sizablepacemanipulate, robustness, etc. Since numerous decades, exclusivepacemanipulate techniques, for example, discipline arranged manipulate (FOC), direct torque manipulate (DTC) and so forthwere consolidated. The FOC scheme encompasses the blessings of -unbiased torque and flux manipulate alike one after the other excited DC device; however, industries in whichuniquemanipulate if crucial, the scheming of particular flux, torque and flux vector perspective is critical; additionally, reliant on device parameters. Numerous articles giftnumeroustechniques to improve the stoutness of FOC in opposition to the parameter dissimilarities; nevertheless, thosetactics enact difficulty and extra excessive computational trouble on virtual controllers. Direct torque manipulate is every otherpacemanipulate scheme, to offerextra static and dynamic torque reaction with the help of predetermined switching desk and hysteresis controllers. Compare to vector manipulate scheme, the DTC is much lesstouchy to uncertainties and parameter versions and additionally works in static reference frame. Nevertheless, for excessiveoverall

performancebusiness drives, the trouble of inconstant switching frequency, massive torque ripples, irrelevant flux regulation, indeterminate stator resistance deviation etc.

OBJECTIVES

The Induction motor is largely used for industrial application due to its speed control and robustness. To enhance the performance of speed controller of the device, the Fuzzy Logic and Artificial Neural Network are used. To achieve the effective speed control and desired power factor, thecustomary vector control methods engage reactive power compensationis used.

2. LITERATURE REVIEW

Nik Rumzi Nik Idris, Tole Sutikno implemented the concept of extra than a few ofthe primary problems, similarly to their root reasonsof Direct Torque Control (DTC) 3-segment induction motor pressure. The excessive torque ripple in DTC pressurebecause of the fact of the hysteresis controller unavoidablyturns into worst with the discrete implementation of the pressure system. The hysteresis controller additionallyreasons variable switching frequency that is based upon on working conditions, specifically the speed. The simplification applied in stator flux expression for voltage vectors choice in flux manipulateseffects in a terrible flux law at low speed. To triumph overthose problems, strategiesthat have beenapplied at UTMPROTON Future Drive Laboratory (UPFDL) are provided and described. Some experimental effectsreceived from the preceding works additionally areprovided and discussed.

John W. Finch and Damian Giaouris executed the use of ac electric machines in managed electric force packages is reviewed. The fundamental varieties of electric machines are in brief summarized to set the context and set up the bodily foundation for the manage strategies used. Machine properties, that are the important thing to a success manage, may be obscured with the aid of using the essential arithmetic required for gadget evaluation and manage scheme The most important recognition of this paper is on manage strategies that are being carried out to make ac drives a unexpectedly developing area. Development of manage is discussed, with attention on current traits appropriate for realistic packages withinside the enterprise with proper dynamic behavior. A specific function is the growing significance of pace or function sensor much less strategies.

Myoung-Ho Shin, Dong-Seok Hyun and Soon-Bong Cho published the research on Maximum Torque Control of Stator-Flux-Oriented Induction Machine Drive within side the Field-Weakening Region.In a traditional stator-flux-oriented (SFO) induction gadget force system, the field-weakening technique is used to differentiate the stator-flux reference in percentage to the inverse of the rotor. This paper investigates why the most torque functionality can't be acquired in a traditional SFO system. This paper proposes a brand new choice technique of flux connection with acquire most torque functionality withinside the field-weakening place through thinking about voltage, torque, and modern The proposed technique is proven through simulation and test with a 5-hp induction motor force.

3. EXSITING SYSTEM

Direct torque manage scheme is has been carried out in modern-day system. Conventional tempo PID controller has been carried out in modern-day system. The manage set of policies

need to embody a complicated computation procedure to remove the variations with inside the weight disturbance.

PROPOSED SYSTEM

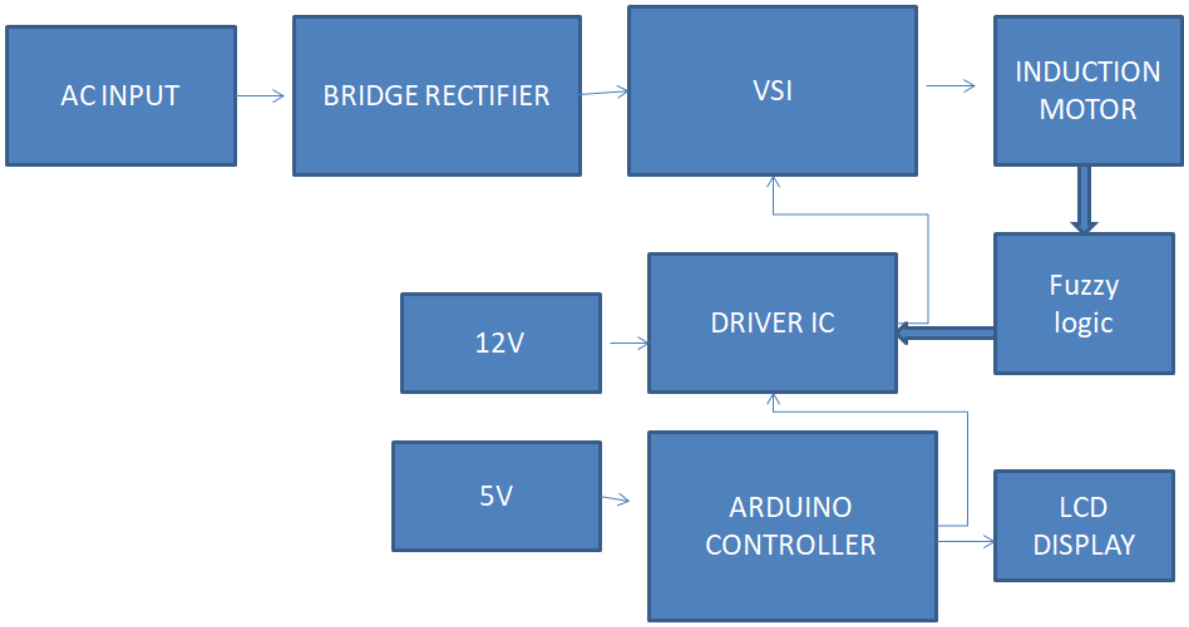

Fig 1: Proposed block diagram

Indirect Vector Control is proposed for manipulate of rotor flux. Fuzzy common sense manipulate scheme is carried out for manipulate of induction motor. This scheme is carried out for manipulate the rate of induction motor. The proposed system subject organized manipulates, direct torque manipulates (DTC) and so forth had been consolidated in proposed system. The manipulate set of rules for reactive strength primarily based totally velocity manipulate of induction motor pressure encompass technology of flux and torque generating additives of contemporary just like vector manipulate; however, vector manipulate engrosses flux estimation. This paper affords a mathematical technique for producing flux thing of contemporary from reactive strength and greater appreciably fuzzy common sense is used to determine the corresponding reactive strength relying upon the reference load torque and velocity.

4. METHODOLOGY

Three phase ac source is get into the system, an electricalmotor is such an electromechanical device which converts electrical energy into a mechanical energy. In case of three phase AC operation, most widely used motor, three phase induction motor as this type of motor does not require any starting device or we can say they are self-starting induction motor.
The working principle of three phase induction motor it may observe that the rotor speed should not reach the synchronous speed produced by the stator. If the speeds equals, there would be no such relative speed, so no EMF induced in the rotor, and no current would be

flowing, and therefore no torque would be generated. Consequently the rotor cannot reach the synchronous speed. The difference between the stator (synchronous speed) and rotor speeds is called the slip. The rotation of the magnetic field in an induction motor has the advantage that no electrical connections need to be made to the rotor. Current Monitoring Current Park‟s Vector, Zero sequence and negative sequence current monitoring and current signature analysis fall under category of Electrical monitoring. These methods use stator current to detect various kinds of machine and inverter faults. In most applications, the stator current of an induction motor is readily available since it is used to protect the machines from destructive over currents, ground currents etc. Therefore current monitoring is sensor less detection method that can be implemented without any extra hardware
condition Monitoring System Condition monitoring means to access the actual condition of motor using the measurements taken while the motor is operating. I mainly use two types of condition monitoring technique to detect different fault. Current and vibration monitoring.
Bearing Fault in Induction motor Bearing is common elements of Induction Machines. They are employed to permit the rotary motion of the shaft. The bearing mainly consists of two rings called the inner and outer rings. A set of balls or rolling elements placed in raceways rotate inside these rings. A continued stress on the bearings cause fatigue failures, usually at the inner and outer races of the bearings. Small pieces break loose from the bearing, called flaking or spalling. These failures result in rough running of the bearings that generates detectable vibrations and increased noise levels. And this process is helped by other external sources including contamination. In some case shaft voltage and current are also sources for bearing failure. High bearing temperature is also another reason for bearing failure.

5. RESULT AND DISCUSSION

The result is displayed between the speed and time. The actual and reference speed of the device are shown in Fig 2.By giving the actual and reference speed, the estimated speed within the particular time is obtained.

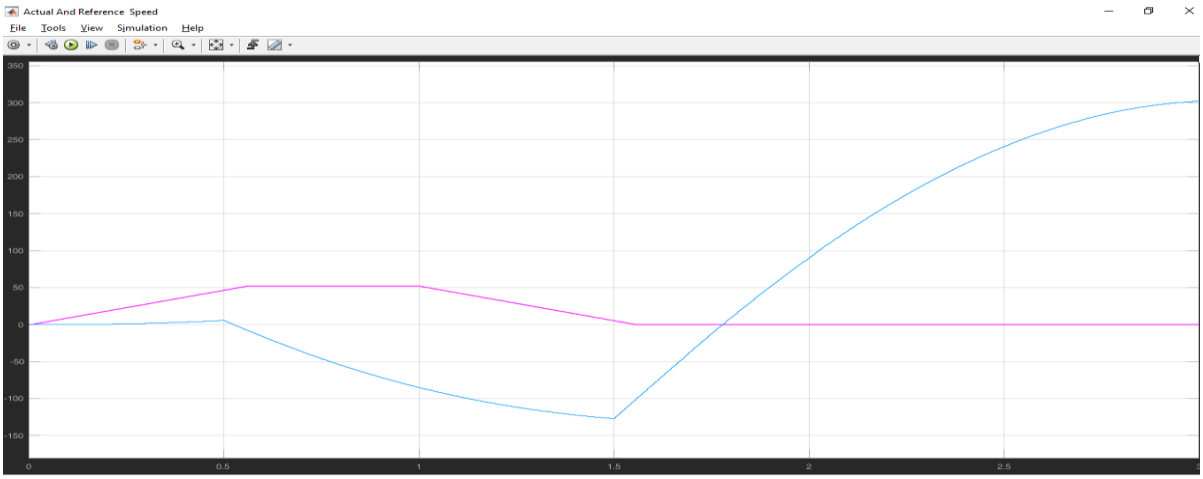

Fig 2: Reference speed and actual speed

The result of rotor speed and electromagnetic torque is given in Fig 3.The result is displayed between speed and torque. As increase in speed the torque remains as constant.

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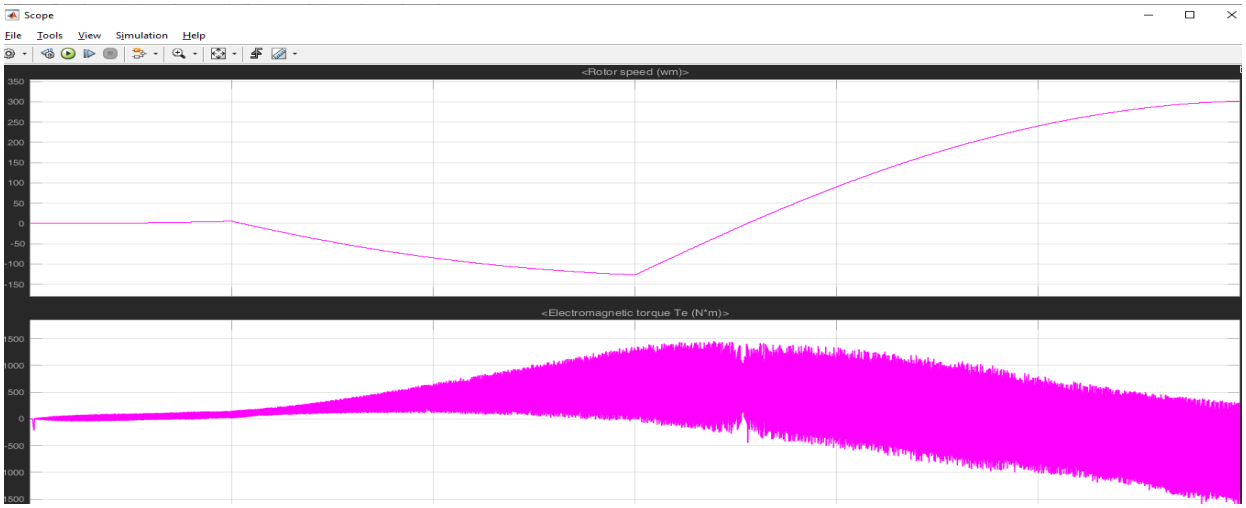

Fig 3: Rotor speed and electromagnetic torque

The result is displayed between time and flux is shown in Fig 4. Initially the variation of flux is high, after certain time it gets to constant. As flux induced the required speed will be obtained.

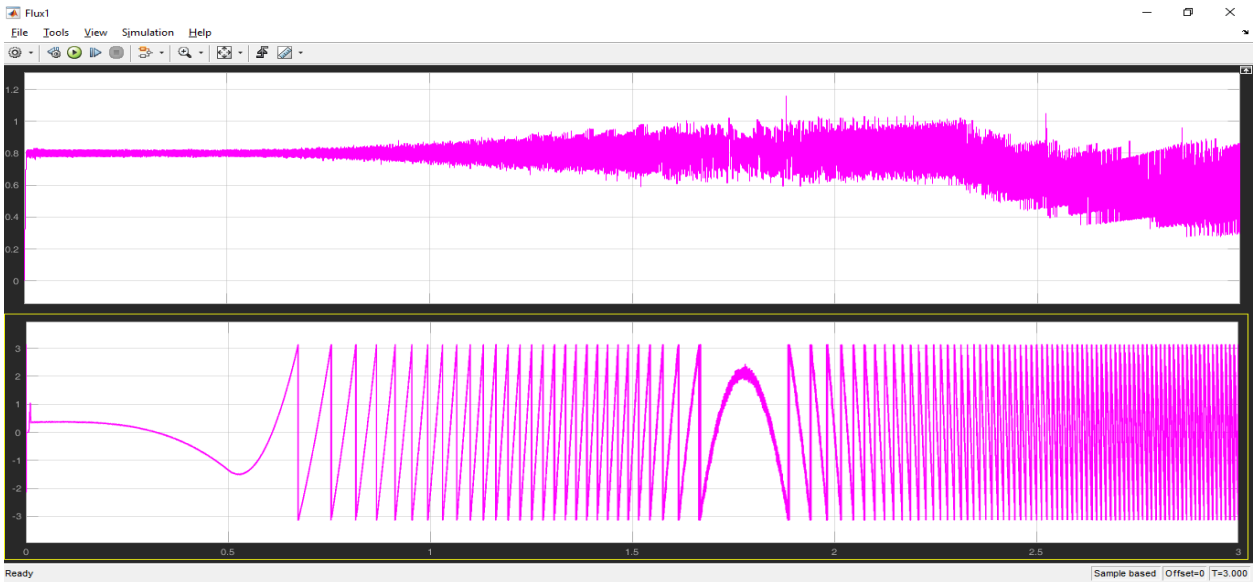

Fig4:Rotor and stator flux

When the speed of the induction motor is controlled by PID controller the motor attains the maximum speed of 750 rpm and it saturates. While it is controlled by Fuzzy Logic Controller, the motor attains maximum speed of 1500 rpm.

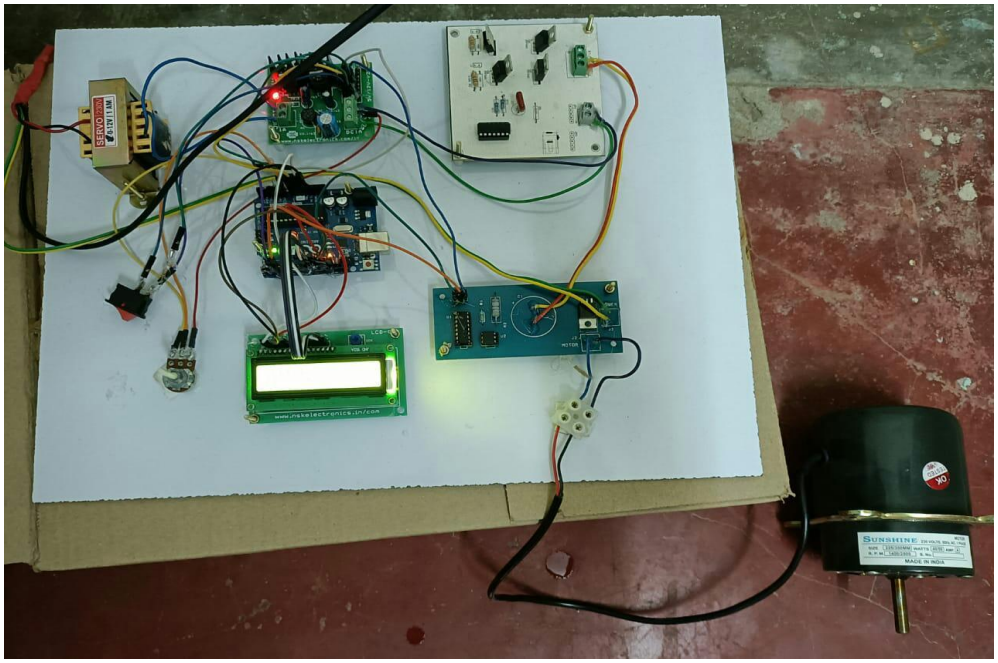

Fig 5 : Hardware Implementation

So the maximum speed control of Induction motor can be efficiently controlled by Fuzzy logic controller than PID controller. The Fuzzy Logic Controller is the rule based controlled which result in high efficient.

6. CONCLUSION

ANN based speed control of induction motor .The Artificial Intelligence techniques, such as Fuzzy Logic and Artificial Neural Network have recently been applied widely in motor drives. The neural controller had a good performances face to parametric variations and to unknown disturbances comparing to the other techniques of control. The optimum reactive power operation using fuzzy expert logic is very precise with finer speed control and reactive power control in both motoring and field weakening mode. Moreover, for example, the customary vector control methods engage reactive power compensation, which has its recognizable confinements; this method shows another successful pathway with the desired power factor. Along these lines, it tends to be presumed that the proposed plan is sensibly effective for the speed control of induction motor drives.

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