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Intelligent Speed Control of Induction Motor (using Fuzzy Logic and Conventional Controller)

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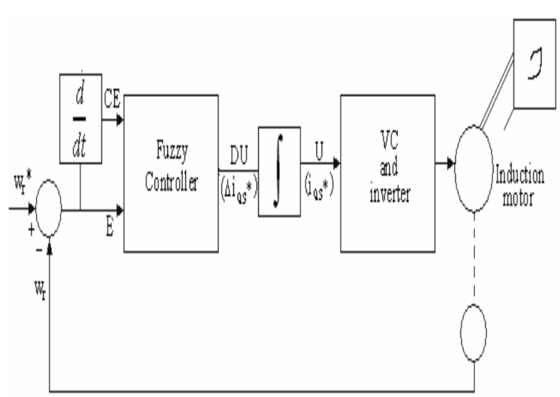
Abstract : This paper present the low maintenance and robustness induction motor have many application in the industries. The V-C method has been optimized by using fuzzy controller instead of a simple P-I controller. The presented hybrid controller combines the benefits of fuzzy logic controller and V-C (vector-control) in a single system controller. The regulation process is achieved through utilization of the fuzzy logic controller in high speed , while stability of the system during transient processes and a operation are assured through application of the vector-control in wide range. Hybrid controller has been validated by applying it to a simulation model. The fuzzy logic controller is implemented using the field oriented control technique as it provides better control of motor torque with high dynamic performance.

I. INTRODUCTION

The traditional approach to building system controllers requires a prior model of the system. The quality of the model, that is, loss of precision from linearization and/or uncertainties in the system's parameters negatively influences the quality of the resulting control. At the same time, methods of soft computing such as fuzzy logic possess non-linear mapping capabilities, do not require an analytical model and can deal with uncertainties in the system's parame'ters. Although fuzzy logic deals with indistinct information, the information is performance in sound mathematical theory. induction machine is an high-level class of electric machines which search wide appoicteness as a motor in industry and in its single phase form in several domestic applications. More than 70% of industrial motors in use today are in fact induction motors. It is substantially a constant speed motor with a shunt characteristic. More then methods have been developed for this purpose including direct torque control, vector control. But due to their peculiar limitations none of them has been found failure-proof. Here speed of induction motor is successfully controlled over wide range with appreciable accuracy using fuzzy logic controller in vector control method.

A. Principle Of Working

This controller shows the pattern of speed loop error singal and updates the output DU so that the actual speed w_r matches the command speed
w_r *.There are two input signals to fuzzy controller,the error
E = w_r * - w_r and the change in error,CE which is related to the derivative $dE/_{dt}$
$\Delta E/_{\Delta r}$ = $CE/_{T_s}$, where CE = ΔE in the sampling time T_S . with constat T_s , CE is proportional to $dE/_{dt}$.
The controller output in a vector controlled drive is Δi_{qs} * current . This signal is summed or integrated to generated the actual control signal U or current i_{qs} * .



The induction motor is fed by a current-controlled Pulse With Modulation inverter which is built using a Universal Bridge block as presented in Figure. The motor drives a mechanical load characterized by inertia J friction coefficient B & load torque uses a fuzzy logic controller instead of a simple proportional integral controller to produce the quadrature-axis current reference iq* which controls the motor torque. The motor flux is controlled by the direct-axis reference of current id*. Block DQ-ABC is used to convert id* & iq* into current references ia*, ib* & ic* for the current regulator. Current & Voltage Measurement blocks provide signals for visualization purpose. Motor current, speed & torque signals are available at the output of the 'Asynchronous Machine' block. The control and power system has been discretized with a time step.Fuzzy and PI controller during starting conditions The PI controller is tuned at rated conditions in order to make a fair comparison. the simulated starting performance of the drive with PI and FLC based drive systems respectively. Although the PI controller is tuned to give an optimum response at this rated condition the fuzzy controller better performances in terms of faster response time and lower starting current. It is worth mentioning here that the performance obtained by the proposed model is 13 times faster than the P-I controller . It achieves the steady state 13 times faster than the P-I controller. Also it is times faster than that obtained earlier by using fuzzy controller.

II. CONCLUSION

Comparative results proves that the perform of vector-control drive with fuzzy controller is superiories to that P-I controller with conventional. Thus by using fuzzy controller the transient response of induction machine has been improved greatly and the dynamic response of the same has been made faster. The robustness in response is evident from the results exact system parameters are not required in the implementation of the controller proposed. The performance of the drive system is robust stable and insensitive to parameters and operating condition variations. The performance has been investigated at different dynamic operating conditions. That shows used FLC controller is more efficient than P-I controller. Its transient response is 13 times faster than a simple P-I controlled system .

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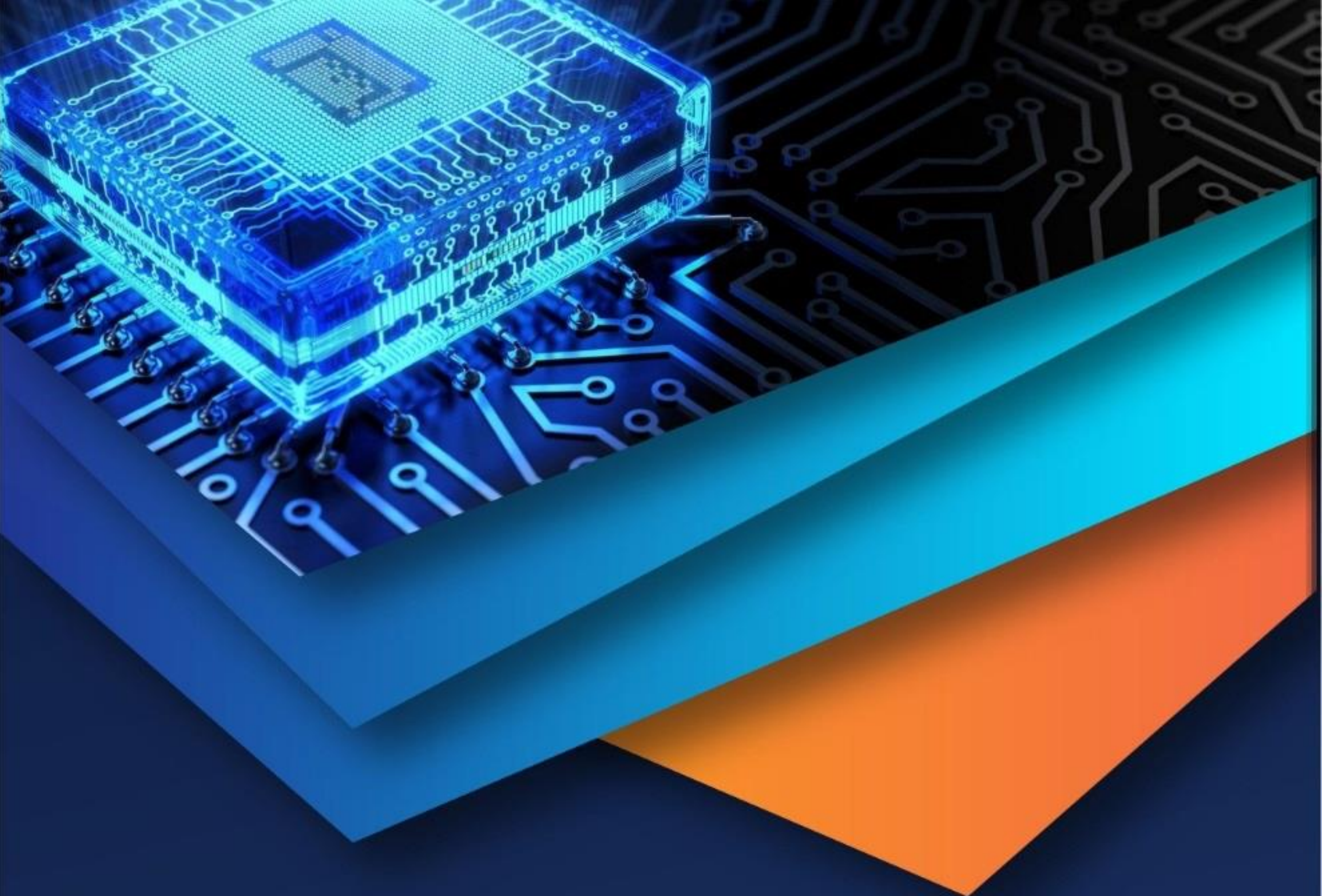

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