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Artificial Intelligence Based Vector Controller for Switched Reluctance Motor (SRM)

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Abstract*: The prevalence of the Switched Reluctance Motors (SRMs) increments step by step because of its points of interest, for example, Simple structure, low cost, less weight, high effectiveness and high beginning torque when contrasted with regular motors. SRM is an electric motor which has invaluable highlights that qualifies it to be utilized in electric vehicle, aviation and industrial applications. In this paper, the switched reluctance motor is controlled using vector control by AI controller (fuzzy) so as to limit the torque ripples by directing torque inside indicated hysteresis band. AI Control of SRM encouraged through an irregular converter. The proposed AI controllers are executed in MATLAB/SIMULINK for specified SRM parameters. As indicated by the attained outcomes the SRM behavior is better when impelled by AI controller in contrast with usual controllers.

Keywords* : Switched Reluctance Motor (SRM), Artificial Intelligence, FLC.

I. INTRODUCTION

SRM is an implausible selection in present variable speed drives for its speed and superior operation under various contexts. SRM has special kind features and several advantages, like simple and rugged structure, doubly salient, economical and it suitable for the various applications are civilian to avian and industry. But, non linearity is the intrinsic drawback of SRM. Due to nonlinearity the motor produces torque ripples and it creates the acoustic noise. Therefore, the motor can operate with controllers and it's added to the cost of motor.SRM is profoundly non-linear and it is doubly-salient, and this causes troubles in both the investigations and control of the SRM. Such a doubly-salient, non-linear machine can't be depicted by regular space-vector hypothesis which, be that as it may, has been widely utilized for the advancement of different direct control designs in induction machine and permanent magnet synchronous drives. In this research FLC based vector torque control technique has been proposed and implemented to improve torque performance of the motor.

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II. PROPOSED TECHNIQUE

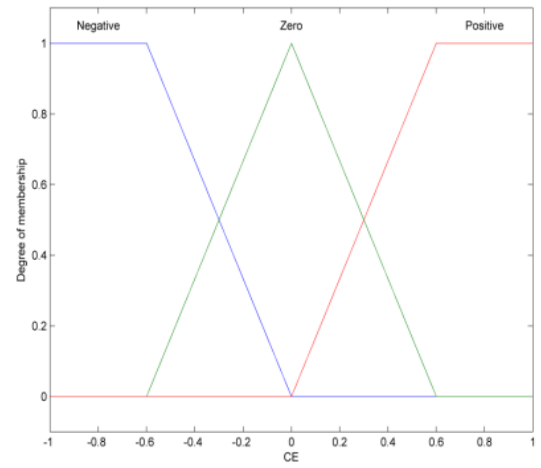
The vector-controlled drives using fuzzy-logic controllers and furthermore fuzzy-neural controllers will be proposed. The major reason for utilizing artificial-intelligence-based controllers is to reduce the tuning efforts related with the controllers and also to acquire improved responses. With

using least configuration artificial intelligence based controllers, it is possible to have DSP implementations which do not have excessive memory and computation requirements. The proposed Fuzzy controller technique is consider the discretization of membership functions for simplicity of coincident execution for the intention of Fuzzification and de-fuzzification, and moreover the consideration of triangular membership functions are suitably illustrated by use distinct values in the look-up table. The association elements of case configuration described for inputs are error (e),change in error (ce) and output (u).In this work fuzzy rule base framework among 9 rules are utilized for the case design and revealed in table.1.

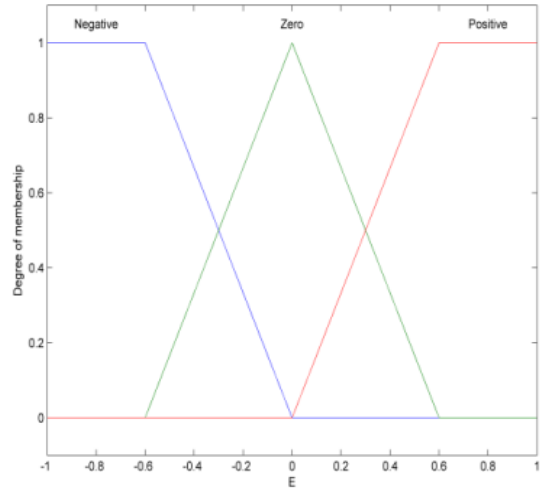
Table.1.Fuzzy rule base matrix among 9 rules

		error(e)		
		N	Z	P
Change in error (ce)	N	N	N	Z
	Z	N	Z	P
	P	Z	P	P

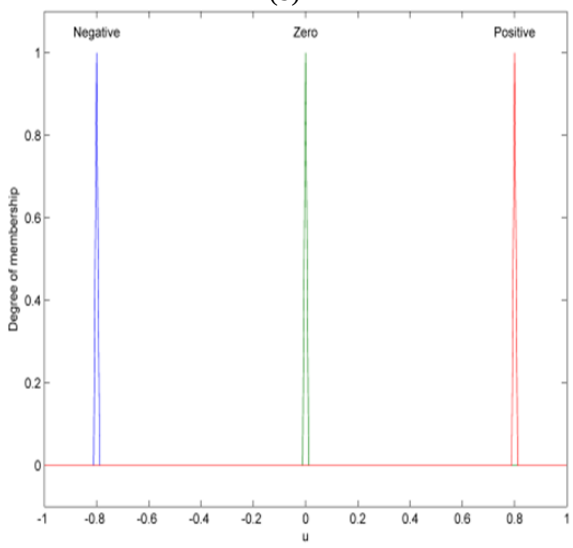
The related elements of error (e), change in error (ce) and u are resolved which perform significant undertakings of the FLC and being primary centered in this research. The reasonable fuzzy sets are planned as appeared in Figure. 1(a),Figure.1(b)and Figure.1(c) individually. State of the fuzzy sets on the two extraordinary parts of the universe of discourse is taken as trapezoidal though all other transitional fuzzy sets are triangular with cover to one another as standard methodology. The width of triangular associate function is partitioned similarly in a range (Universe of Discourse) with cover to one another.



(a)



(b)



(c)

Figuge.1.(a),(b),(c) Associate functions of standard for ERROR (e), change in ERROR (ce) and output (u)

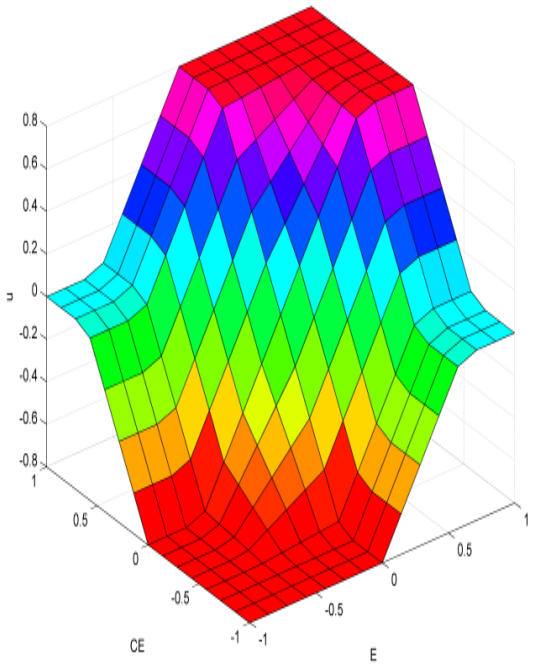


Fig.2.Fuzzy Logic Controller profile

Fig.2 illustrates the highly non-linear 3-D controller profile of the realized speed and flux using fuzzy-logic controllers. Despite the fact that the Although the control profiles of the conventional controllers are simpler, which additionally compare to less difficult advanced usage, it is still incredibly helpful to actualize the more complex Fuzzy controllers bringing about increasingly complex control surfaces. This is because of the way that the fuzzy controllers are versatile controllers. In this way, by suitable fine-tuning it is conceivable to get superior dynamic attributes in the entire running circumstances. This likewise demonstrates the presence of the decrease in tuning exertion related with fuzzy controller.

III. RESULTS AND DISCUSSIONS

The implementation of recommended control drive is attained through simulation results and results are conceived by utilizing Matlab/Simulink. Figure 3 shows the Responses of torque producing Stator current and flux reference under normal. Fig.4 illustrates that the responses of flux, current, torque of vector control SRM drive using FLC.

The results are differentiated with acquired results of simulation of FLC based chopped current control of SRM. Figure.5 exhibits the results of both actual and reference control of SRM. From the desired output it is crystal clear through proposed control and flux and torque drenched with hysteresis band both in the interim of transient and steady state conditions despite the fact that the flux linkage hysteresis band is by all accounts marginally gargantuan. The abundance of RMS phase current is satisfactory in light of the fact that it is streamlined to diminish during the design procedure.

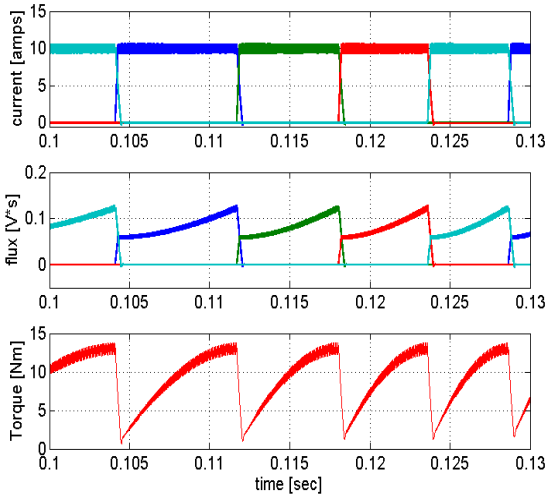


Fig.3.Responses of torque producing Stator current and flux reference under normal

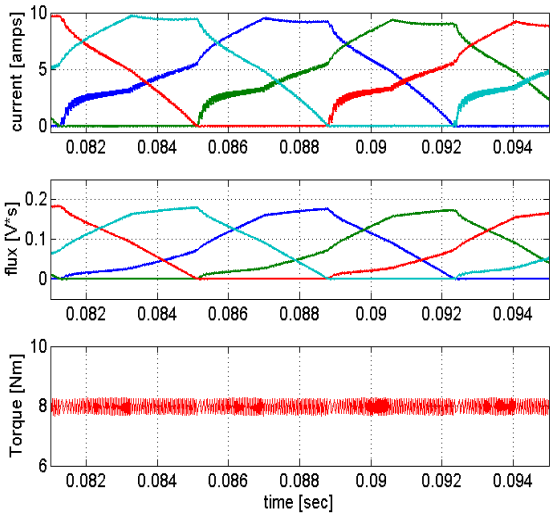


Fig.4.vector control of SRM Drive Responses of flux, current, torque producing using FLC

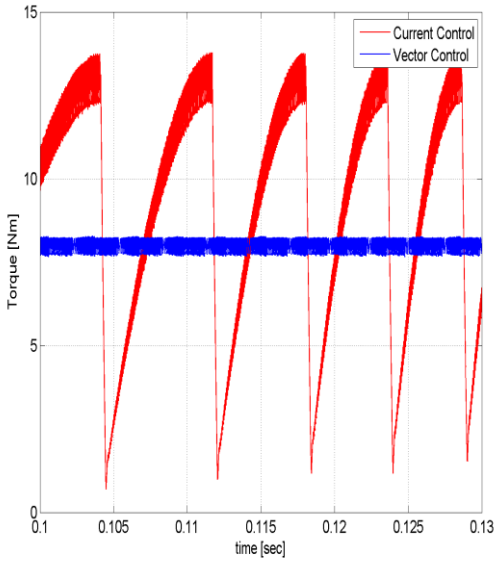


Fig.5. Responses of torque control by comparison of vector control and current control

IV. CONCLUSION

In this work, Artificial Intelligence based vector controller approach for reduction of disturbance in SR Drive is proposed. The proposed technique is employed and the output results are demonstrated its performance and reduction of torque ripples in the motor and obtained response is superior to the conventional techniques.

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