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Sensor less Control of Switched Reluctance Motor

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Abstract: Switched reluctance motor is considered for variable speed applications. It is a power device which can be manufactured easily and inexpensively and relatively high reliable. A sensor less control of SRM is proposed. Here, the communication of SRM is done without use of position detector. It is ensured that the switching of each phase winding takes place during positive slope of inductance profile. Simulation is carried out using MATLAB. A 6/4 SRM is used for this purpose.
Keywords: switched reluctance motor, inductance sensing method, comparator, SRM parameters.

I. INTRODUCTION

The switched reluctance motor is an electric motor in which torque is produced by the tendency of its moveable part to move to a position where the inductance of the excited winding is maximized. SRM is a type of synchronous machine.it has wound field coils of a dc motor for its stator winding and has no coils or magnets on its rotor. It can be seen both the stator and rotor have salient poles hence, the machine is a doubly salient, singly excited machine. Switched reluctance motor drives are suitable for various applications such as EV, aircraft, starter/generator systems, mining, drives, robotics etc due to its high fault-tolerant capability, rugged structure and large torque output over wide speed range. Conventionally SRM driver obtain accurate rotor position information via optical encoders/Hall sensors. However, it is not only increases the complexity and cost it also reduces reliability. Thus development of most effective sensor less control technology for SRM drive is quite necessary for high reliability at low cost. The sensor less control technology method used is inductance sensing method. The aim of the project is to find the accurate rotor position of SRM without sensors.

II. EXISTING AND PROPOSED SYSTEM

The existing systems use speed encoders, Hall Effect sensors which increase the cost and volume of the SRM drive system.

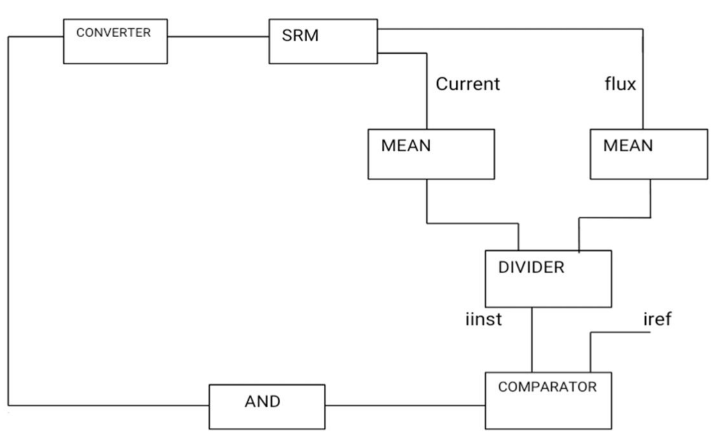
A. *Limitations Of Existing System*

1) The cost of the system is very expensive.
2) Complexity is high.
3) The volume of the drive increases.

B. *Proposed System*

The proposed new model developed is sensor less control of switched reluctance motor. It is developed using MATLAB software. we are using the inductance sensing method to detect the position of the rotor.

III. BLOCK DIAGRAM



Block Diagram of the proposed system.

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IV. SIMULATION DIAGRAM

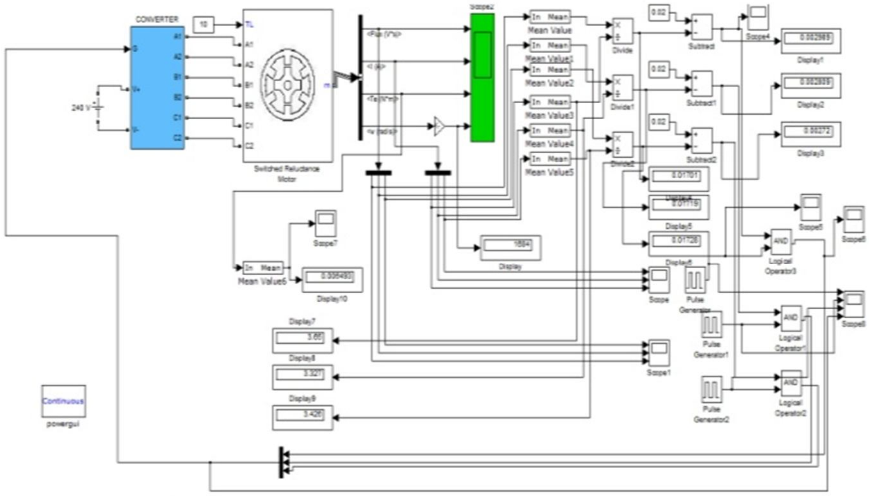


Fig. 4: Simulation Model of the sensor less SRM drive

V. WORKING

Running of SRM requires a DC source, power convertor like asymmetric H-bridge. DC source can be obtained by using any AC-DC convertor. There are many power convertors which are used for driving SRM. Controllers are used to control timing and width of switching pulses given to power switches of power convertor. Due to its non-linearity SRM produce all three types of torques i.e., zero, positive and negative torque. Pulses should be given to power switches at the instants when rotor is in such position that machine can give positive torque to rotor. So, basis of controller is position sensing. Now position sensing can be done by either using sensor or without sensor i.e., sensor less. In sensor less methods position of rotor is to be estimated. More accuracy in position sensing leads to good performance as accuracy increases machine performance also improves. This method is based on the comparison of the estimated flux linkage and the reference flux linkage in order to define turn-off (commutation) position. This is called on-off control method. In this method, actual flux linkage value is compared with reference value. When the estimated flux linkage is nearly equal to the reference flux linkage, it indicates that the switching position has been reached and the commutation can be performed. Gate pulse is removed, convertor switch is turned off and the following phase is turned on. Reference flux linkage is obtained from the magnetization characteristic as a function of phase current for the desired commutation position. The reference flux linkage is obtained from the flux linkage in the aligned position of the rotor. Flux linkage is calculated and it is compared with the reference level from the reference magnetization curve.

VI. RESULTS

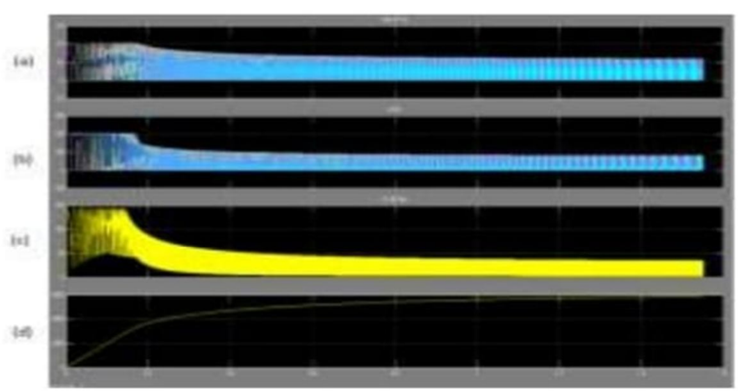


Figure 7 (a) flux, (b) current, (c) torque and (d) speed plot on the scope

VII. SRM PARAMETERS

Table (1) SRM parameters used in the Simulink model.

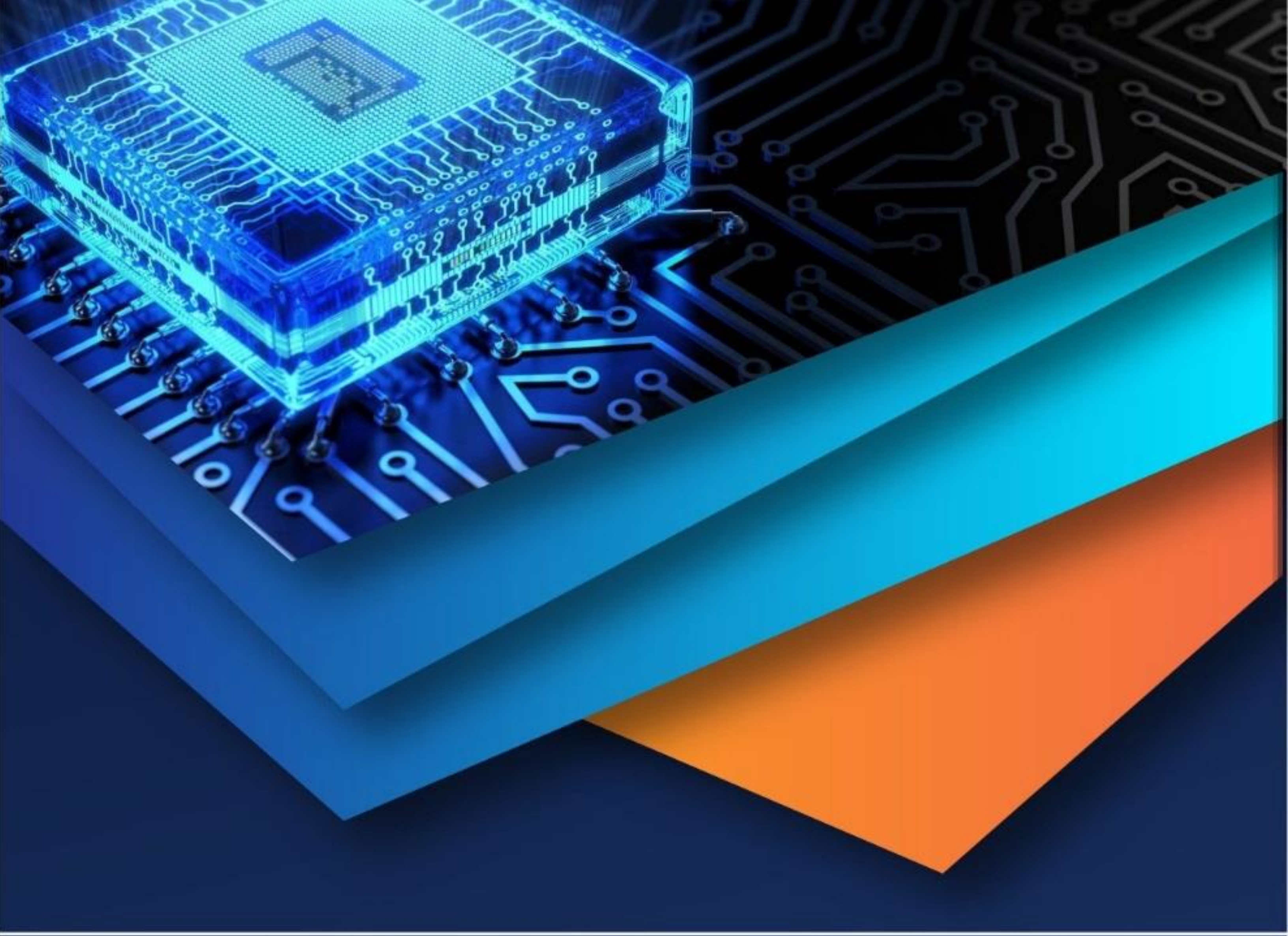
Motor parameters	Values
Rated Power	60kW
Number of Phases	3
Number of Stator Poles	6
Number of Rotor Poles	4
Aligned Phase Inductance	23.6mH
Unaligned Phase Inductance	0.67mH
Inertia	0.05Kg.m
Stator Resistance	0.05Ω
DC Voltage Supply	240V

VIII. CONCLUSION

Of all the methods used to start SRM, three phase excitation method is most effective but care should take while implementing because if we give keep supply for long time the rotor will change the position. In sensor less methods used for steady state operation, inductance-based estimation method is more reliable because it easy to implement. While state observer is computationally intensive and have the problem of convergence in terms of the time taken to converge to the correct estimates. Still it has been studied extensively to tackle problems of the nonlinear dynamic control systems.

REFERENCES

[1] Buju G. S., Menis Roberto and Valla Maria. J, “Variable Structure Control of an SRM Drives”, IEEE Trans. on Ind. Electron., Vol. 1, Feb 1993, pp 56-63.
[2] R. Krishnan, “Switched Reluctance Motor Drives: Modelling, Simulation, Analysis, Design, and Applications”, CRC Press, 2001.
[3] T. J. E. Miller. “Electronic control of switched reluctance motors”. Newnes Power Engineering Series Oxford, UK, 2001. TMS320F2812 Datasheet, Texas Instruments, 2002
[4] F.Soares, P.J.Costa Branco, “Simulation of a 6/4 Switched Reluctance Motor Based on Matlab/Simulink Environment,” IEEE Trans. on Aerospace and Electronic System, vol. 37, no. 3, pp. 989-1009, July 2001.
[5] G. Baoming and Z. Nan, “DSP- based Discrete-Time Reaching Law Control of Switched Reluctance Motor”, IEEE International conference IPEMC, 2006, pp. 1-5.



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