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Switched Reluctance Motor Speed Control

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I. INTRODUCTION

The switched reluctance motor (SRM) is a type of motor doubly salient with phase coils mounted around diametrically opposite stator poles. There are no windings or permanent magnets on the rotor. The rotor is basically a piece of (laminated) steel and its shape forms salient poles. The stator has concentrated coils. Switched reluctance motors (SRM) have a simple and robust structure, thus they are generally suitable for high-speed applications. High-speed motors have the advantage of high power density, which is an important issue of traction motors in electric vehicles (EV). Therefore, high speed SRM seems to be promising candidates for this application.

II. LITERATURE SURVEY

The control of the SRM may not be as easy as conventional electric motors. Torque ripple, which is one of the main problems, may and must be reduced by the controller. Different types of controllers can be used—the fundamental ones are voltage impulse, current, and torque controllers. Impulse control is essentially used for high speeds, while current and torque controllers are used for high performance. As the produced torque does not depend only on the current but also on the non-linear derivative of the inductance, a constant current control is not sufficient for high performance. Reference current waveforms, or torque waveforms, have to be calculated for the response to have the minimum ripple torque component possible. Also, current dynamic has to be considered in the controller design. The inductance changes along the rotor position and so does the current dynamic. The back-EMF also has an effect in the current dynamic, especially at high speeds. Numerical simulations of a real SRM model were performed. Steady-state results of the reference operating point and on a speed and load change were analyzed. Moving away from the used operating point to design the controller changes the response, as expected. The dynamic behaviour was also simulated. It contemplates all four quadrants of operation. The speed response follows the reference speed with good accuracy. The load changes provoke perturbations on speed, which are compensated very quickly by the controller.

III. SYSTEM ARCHITECTURE

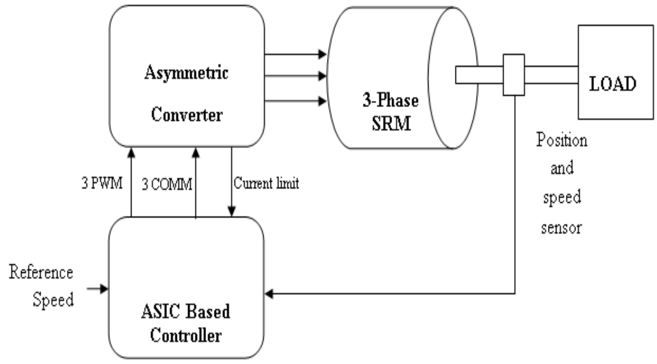

Fig Block diagram

Block diagram shows the proposed ASIC based SRM drive; mainly consist of Asymmetric Converter, 3-phase SRM, ASIC based Controller, position and speed sensor. Here Asymmetric Converter is used to energized and de-energized the 3 phases of Switched Reluctance motor (SRM). The shaft position sensor sends rotor position and speed information to the controller, which provides signals to the power Asymmetric Converter to synchronize the energizing of the three stator phase windings and rotor position information transmitted by three shaft position sensors.

The LMB1008 is a mixed analogu4digital ASIC and was designed by National Semiconductor using its BUX3Cs standard cell library. The ASIC design was based on a discrete controller built at Glasgow University. The die measures 0.16 inches square and is housed in a 28 pin DIL plastic package. The main features of the LMB 1008 are as 1 Commutation/firing angle control. 2Bidirectional operation. 3 Current Limit 4. Open-loop or closed-loop speed control. A diagram outlining the partitioning within the device and a complete switched reluctance drive based on the LMB1008 is shown The shaft position sensor sends rotor position and speed information to the control ASIC which provides gate signals to the power phase legs to synchronize the energising of the three stator phase windings. Rotor position information a;insmiued by three shaft position sensors is decoded by the control chip logic. By combining these with the commutation mode, run/stop and direction demands set by the operator one of five possible commutation strategies is selected . Four of the commutation modes are motoring conditions with advanced turn on angles for use at higher speed. It should be noted that all modes are available in both directions. The resulting

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three commutation outputs are sources for the gate drive to the lower switch of each phase

Speed control is achieved through pulse width modulated (PWM) control of the motor phase voltages. By varying the duty cycle of the phase voltages we can control the average phase voltage and therefore the motor speed. Actual motor speed is derived from a shaft sensor the frequency of which is proportional to speed. This frequency is converted to a proportional voltage within the ASIC, which is then subtracted from desired speed to derive the error signal. The PWM signal is combined with the commutation signals within the control ASIC and the resulting three signals are used to control the gate drives of the three upper switches of an asymmetric converter

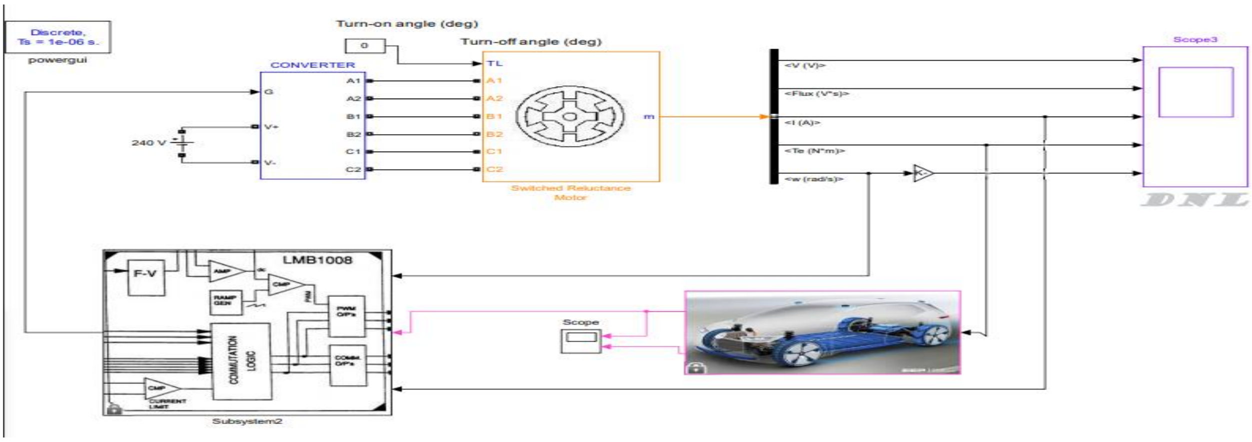
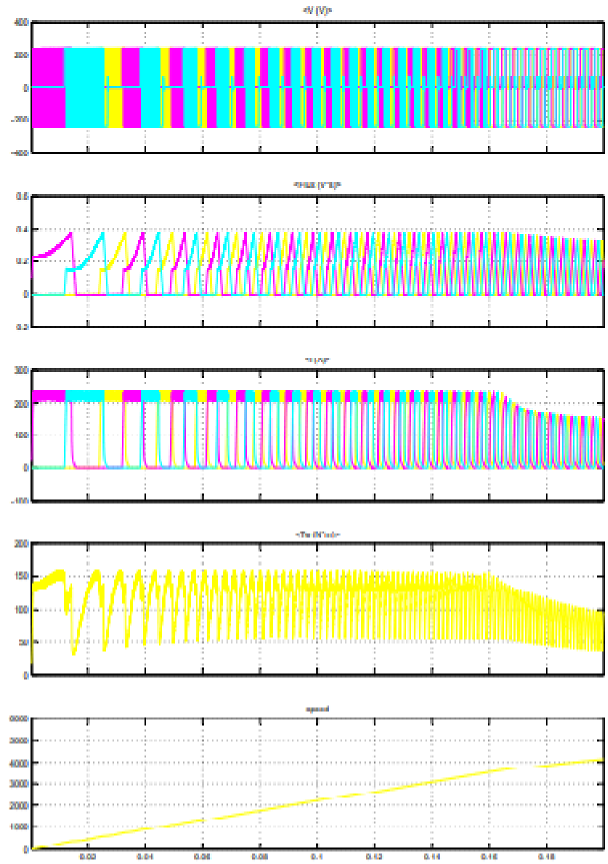


Fig Matlab Simulation SR Motor Speed Control

IV. RESULT



Graph shows five output of switched reluctance motor and relation with each other (voltage current ,flux ,torque and speed).Speed of switched reluctance motor reaches 5000 rpm with in very short time

V. CONCLUSION

ASICs is very wide as they are basically used everywhere where there is a need for performance, customization and size. Such as controller for Switched reluctance machines (SRMs) and have the advantages of simple structure, low manufacturing cost, high system reliability, high efficiency, and a wide speed range, and are contenders for electric vehicle traction drives

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