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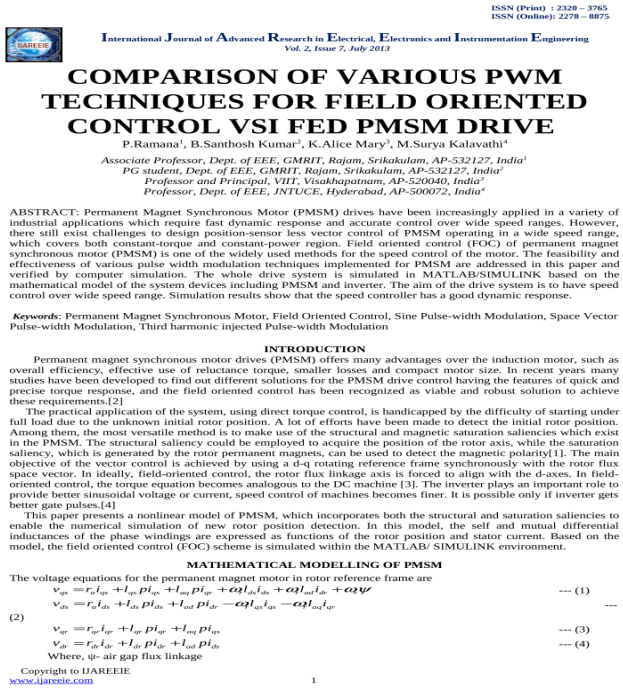

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COMPARISON OF VARIOUS PWM TECHNIQUES FOR FIELD ORIENTED CONTROL VSI FED PMSM DRIVE

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ABSTRACT: Permanent Magnet Synchronous Motor (PMSM) drives have been increasingly applied in a variety of industrial applications which require fast dynamic response and accurate control over wide speed ranges. However, there still exist challenges to design position-sensor less vector control of PMSM operating in a wide speed range, which covers both constant-torque and constant-power region. Field oriented control (FOC) of permanent magnet synchronous motor (PMSM) is one of the widely used methods for the speed control of the motor. The feasibility and effectiveness of various pulse width modulation techniques implemented for PMSM are addressed in this paper and verified by computer simulation. The whole drive system is simulated in MATLAB/SIMULINK based on the mathematical model of the system devices including PMSM and inverter. The aim of the drive system is to have speed control over wide speed range. Simulation results show that the speed controller has a good dynamic response.

Keywords: Permanent Magnet Synchronous Motor, Field Oriented Control, Sine Pulse-width Modulation, Space Vector Pulse-width Modulation, Third harmonic injected Pulse-width Modulation

INTRODUCTION

Permanent magnet synchronous motor drives (PMSM) offers many advantages over the induction motor, such as overall efficiency, effective use of reluctance torque, smaller losses and compact motor size. In recent years many studies have been developed to find out different solutions for the PMSM drive control having the features of quick and precise torque response, and the field oriented control has been recognized as viable and robust solution to achieve these requirements.[2]

The practical application of the system, using direct torque control, is handicapped by the difficulty of starting under full load due to the unknown initial rotor position. A lot of efforts have been made to detect the initial rotor position. Among them, the most versatile method is to make use of the structural and magnetic saturation saliencies which exist in the PMSM. The structural saliency could be employed to acquire the position of the rotor axis, while the saturation saliency, which is generated by the rotor permanent magnets, can be used to detect the magnetic polarity[1]. The main objective of the vector control is achieved by using a d-q rotating reference frame synchronously with the rotor flux space vector. In ideally, field-oriented control, the rotor flux linkage axis is forced to align with the d-axes. In field-oriented control, the torque equation becomes analogous to the DC machine [3]. The inverter plays an important role to provide better sinusoidal voltage or current, speed control of machines becomes finer. It is possible only if inverter gets better gate pulses.[4]

This paper presents a nonlinear model of PMSM, which incorporates both the structural and saturation saliencies to enable the numerical simulation of new rotor position detection. In this model, the self and mutual differential inductances of the phase windings are expressed as functions of the rotor position and stator current. Based on the model, the field oriented control (FOC) scheme is simulated within the MATLAB/ SIMULINK environment.

MATHEMATICAL MODELLING OF PMSM

The voltage equations for the permanent magnet motor in rotor reference frame are

$$v_{qs} = r_s i_{qs} + l_{qs} p i_{qs} + l_{ad} p i_{qr} + \omega_r l_{ds} i_{ds} + \omega_r l_{ad} i_{dr} + \omega_r \psi \quad \text{--- (1)}$$

$$v_{ds} = r_s i_{ds} + l_{ds} p i_{ds} + l_{ad} p i_{dr} - \omega_r l_{qs} i_{qs} - \omega_r l_{ad} i_{qr} \quad \text{--- (2)}$$

$$v_{qr} = r_{qr} i_{qr} + l_{qr} p i_{qr} + l_{aq} p i_{qs} \quad \text{--- (3)}$$

$$v_{dr} = r_{dr} i_{dr} + l_{dr} p i_{dr} + l_{ad} p i_{ds} \quad \text{--- (4)}$$

Where, ψ- air gap flux linkage

transistors, Proceedings of the Third International Conference on Power Electronics and Variable-Speed Drives, July 1315, , pp. Sharaf, K. M.Abstract: Variable speed drives in chemical and petrochemical plants need a high reliability and availability. Therefore redundancy is often realized in the power converter and other subsystems. Electronics and Variable-Speed Drives , Third International Conference on. Article #. Date of Conference: July Published in: Power Electronics and Variable-Speed Drives, Third International Conference on. Article #. Date of Conference: July Date Added to.Results 1 - 25 of Electronics and Variable Frequency Drives: Technology and . Speed Drives (I E E Conference Publication) - Third International. Conference on Power Electronics and Variable-Speed Drives, July - Sixth.power supply (SMPS) for variable output voltage (28/10/15) Supplies and Variable Speed Motor Drives. Produce International Conference on Power Electronics and E Conference Publication) - Third International. Conference on Power Electronics and Variable-Speed Drives, July - Sixth.Transactions on Power Electronics covers fundamental Supplies and Variable Speed Motor Drives E Conference Publication) - Third International. Conference on Power Electronics and Variable-Speed Drives, July - Sixth.Proceedings of the 3rd International Conference on Power Electronics and Variable Speed Drives, July. , London. Published: 01/01/ Document.P.R. Palmer and A.N. Githiari, IEEE Transactions on Power Electronics, Vol. and P.R. Palmer, IEE Power Electronics and Variable Speed Drives Conference, , London, July ; "Switch-off circuits for transistors and gate turn-off . 3rd International Symposium on Power Semiconductor Devices and ICs, pp.Transactions on Power Electronics covers fundamental E Conference Publication) - Third International Variable-Speed Drives, July - Sixth.Supplies and Variable Speed Motor Drives Produce Large Noise Currents Drives (I E E Conference Publication) - Third International Conference on Drives, July - Sixth International Conference on Power.International PCI Conference (15a: Munic, Alemanya) . Third International Conference on Power Electronics and Variable-Speed Drives: 15 July Third International Conference on Power Quality: end-use applications and.IEEE International Power Electronics and. Application plenary session with parallel workshops over four days., 3rd International Power Electronics and Variable Speed Drives - July - International Conference on Power.International Journal of Electrical Engineering Education (IJEEE), Vol. . DSP Microprocessor', Proceedings of the Third International Conference on Power Electronics and Variable Speed Drives, IEE Savoy Place, London, July, 3rd. International Conference on Power Electronics and Variable Speed Drives,. London, July , pp. 8. Taufiq J.A., Xiaoping J., Allan J. and.machine drive with a component minimized voltage fed inverter under topologies for fixed and variable frequency output , IEEE Trans. on Power Power Elect., Vol, No.4, July , pp. Conference PESC 99, 30th Annual IEEE, Vol. 2, Instrumentacion, SAAEI , Terrassa-Spain, Sept. Rec. , , pp.IEEE Eindhoven PowerTech, Eindhoven, Netherlands, 29 June - 2 July .. 7th IET International Conference on Power Electronics, Machines and Drives .. The

Electric Power System of the Future-, Bologna, Italy, September , .. Maximum Efficiency Point Tracking for Adjustable-Speed Small Hydro Power.Chapter 1 Power Semiconductor Devices for Variable Frequency Drives 9. B. J Baliga national and international conferences in this area. The machine is a.