Characteristic Analysis of Permanent Magnet Assisted Synchronous Reluctance Motor for High Power Application

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Abstract **- In this paper, finite element analysis for a permanent magnet assisted synchronous reluctance motor (PMASynRM) is presented and the inductance, torque characteristics analysis is performed under the effect of saturation. Comparisons are given with inductance and torque characteristics of normal Synchronous reluctance motor (SynRM) and those according to quantity of residual flux density (0.1T - 0.4T) in PMASynRM, respectively. Comparisons are given with output characteristics of normal Synchronous reluctance motor (SynRM) and those according to the load in PMASynRM, respectively. And It is confirmed that the proposed model result in high output power performance.**

I. INTRODUCTION

The performance of a synchronous reluctance motor (SynRM) in terms of torque and power factor depends on the two-axis inductance Ld and Lq of the machine. The large difference of (Ld - Lq) and Ld/Lq ratio are good for the machine's properties. Therefore, Considerable attention has been paid in the past to improve rotor design of SynRM [1] – [3].

By adding a proper quantity of permanent magnets the torque density and power factor of SynRM can be greatly increased. It is called Permanent Magnet Assisted Synchronous Reluctance Motor(PMASynRM).

Finite element methods have the abilities to model the complicated internal structure within a PMASynRM and to model magnetic saturation to a high degree of accuracy.

In this paper, finite element analysis for a permanent magnet assisted synchronous reluctance motor (PMASynRM) is presented and the inductance, torque characteristics analysis is performed under the effect of saturation. Comparisons are given with inductance and torque characteristics of normal Synchronous reluctance motor (SynRM) and those according to quantity of residual flux density (0.1T - 0.4T) in PMASynRM, respectively.

The focus of this paper is characteristics analysis of d, q axis inductance and output power according to magnetizing quantity of interior permanent magnet for PMASynRM.

TMS320C31 DSP installed experimental devices and test machine are equipped and performance characteristics according to load are investigated. The d, q current component ratio, load angles of a PMASynRM are investigated quantitatively on the basis of the proposed analysis method and the experimental test.

Experimental Comparisons according to load are given with output characteristics curves of normal Synchronous reluctance motor (SynRM) and those according to the load in PMASynRM as shown in Fig. 3, 4, respectively. And It is confirmed that the proposed model result in high output power performance.

II. ANALYSIS MODEL

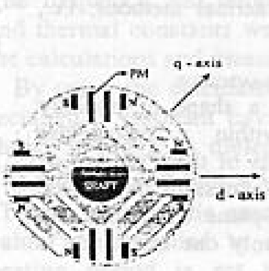

Fig.1 Rotor cross-section of PMASynRM

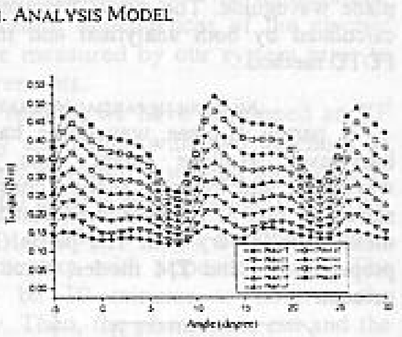

Fig.2 Torque characteristics according to residual flux density of PMASynRM

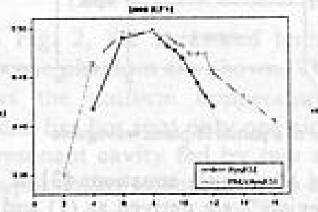

Fig. 3 output characteristic at 2000rpm

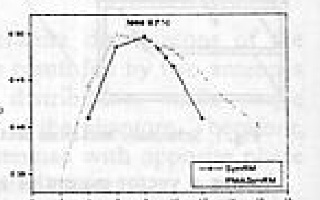

Fig. 4 output characteristic at 3000rpm

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