DESIGN OPTIMIZATION OF PERMANENT MAGNET BRUSHLESS DC MOTOR

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ABSTRACT:
This paper presents performance analysis of permanent magnet brush less dc motor (BLDC) using FEA based CAD package MagNet 6.13.First the characteristics of the standard BLDC motor is analysed. Then the design modifications are introduced and the performance of the machine is analysed. Based on the results optimum design is obtained.
Key words: BLDC motor, finite element method, CAD.

INTRODUCTION

BECAUSE of the distinct advantagesof high efficiency,high power density and minimal maintenance,thepermanent magnet (PM) brush less dc machine is becoming increasingly attractive for industrial and electric vechile(EV)applications[1],[2].

Brush less dc motor comprised of armature core of magnetic material having saliencies and field magnets having magnetized poles, are widely used in the fields of audio and video, office automation for the purporse of constant speed operation and high precision control

In this paper BLDC motor with the given dimensions given in the table no: 1is modeled using FEA based cad package MagNet 6.13. Performance of the machine is analyzed by varying the airgap, material variation applied to the component, skewing of stator.

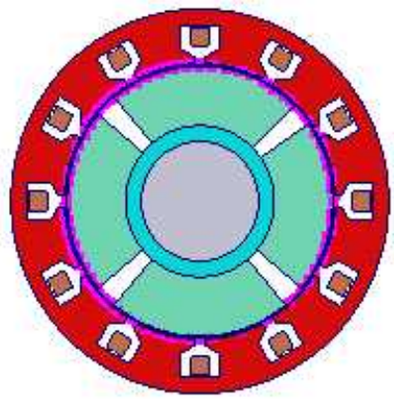

Fig. 1 Brush less DC Motor Model

Quantity	Value	Unit
Stator outer diameter	52.8	mm
Stator inner diameter	23	mm
Air gap diameter	22.5	mm
Rotor diameter	20	mm
No of poles	4	mm
No of slots	12	mm
Phases	3	mm
Tooth Width	3	mm
Slot height	10	mm

Table 1. Design Data.

RESULTS:

Fig. 2 2-D Mesh

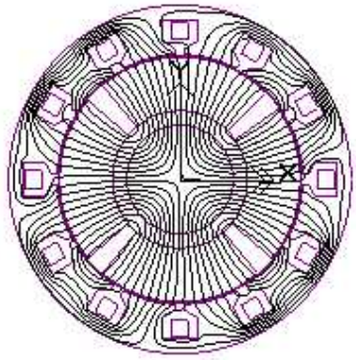

Fig.3 Flux Patterns

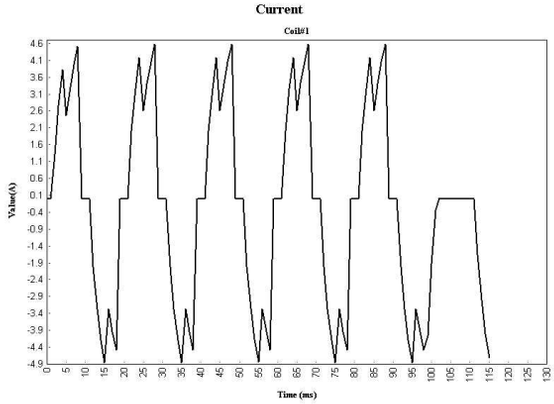

Fig. 4. Current waveform

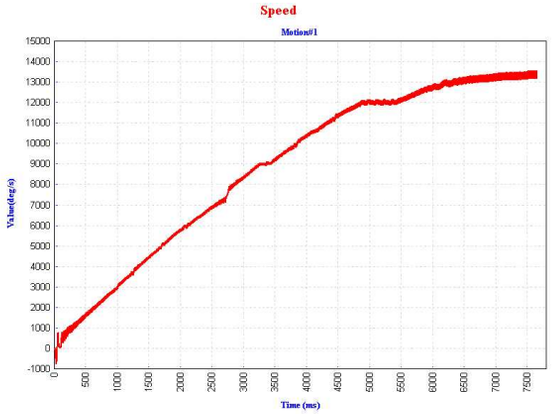

Fig.5 Speed Characteristics

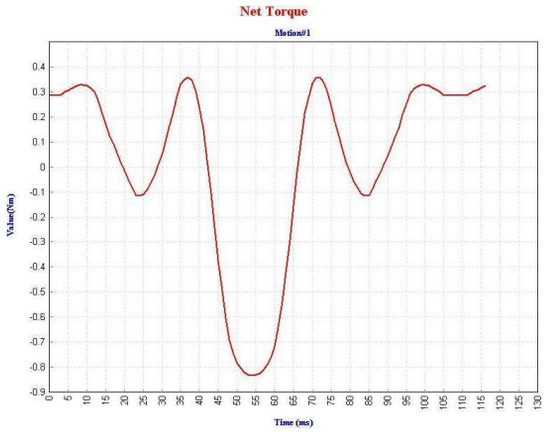

Fig 6. Torque Characteristics

Material	Torque	Flux
NdFeB	8.4013 Nm	0.492 wb
Semarium Cobalt	6.814 Nm	0.4996 wb

Table 2. Material Variations:

CONCLUSION:

For various design modifications, the performance of the machine is analyzed using FEA based CAD package using MagNet 6.13 . The machine with minimum air gap is found to have better performance. Skewing the machine minimizes the cogging torque.

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