Abstract

With a view to apply all the advantages in the consumer or domestic applications, field where the energy efficiency and robustness is vitally expected, this project is to apply this power efficient motor for domestic appliances and hence to design, and to optimize with the finite element analysis and taking care of the rating and the size constraints suited to the domestic applications.For designing the PMBLDC motor for domestic applications, a Computer Aided Program is developed using the MATLAB using its M-File programmability

The designing program is successfully developed using MATLAB and a motor of 0.75HP is designed for the domestic applications using the same program developed.

An optimization study has been carried out by changing some fixed or assumed parameters, for fixing the output torque, size constrains, rotor inertia etc, and the effects of the same parameters has been studied for the change in the effect of variation in a single parameter on the designed parameters. And after individual study, all the parameters were changed and cumulative effect of all the fixed parameters for the same design, and an optimized final design has been obtained.

This work is an effort in the direction of designing and using the energy efficient PM motors for the domestic applications which is the field that requires energy efficient, noise less, small sized motors to be designed and with the same constraints the design is carried out.

The motor design for the 0.75 HP 1500 rpm rating of the load with the size constraints of: diameter upto 13 cms., Length upto 6.00 cms and the designed parameters are found to be within these limits with efficiency of 91.318%.

The Finite Element Analysis of the motor for above design specifications and geometry and with changing the slots and poles in various combinations is done with the results when compared with the theoretical predictions, confirmed with all.

The results of the FE Analysis show that:

1. The PMBLDC motor is in the range for the highly efficient motors and that makes it to have high power out put with small size giving it a two good qualities to be fitted in fraction HP motors. Hence this project is the work in the direction of designing for 0.75HP, 1500 RPM.
2. Matlab m-file CAD program is developed successfully giving fairly competitive values of design data
3. The design and optimization using same m-file codes have been carried out with quite reasonable design values
4. FE Analysis study has been done in an extensive way with large amount of data output for various kind of combinations of slots and poles, we can say that:
    a) Increase in numbers of poles is beneficial up to the point where magnet leakage flux, core losses and drive frequency begin to have detrimental effect on motor performance
    b) More slots increases current density and hence reduces torque but makes good Bg distribution and reduces cogging torque for fraction pitching.
5. Out of all, the topology with 24 slots, 4 poles, (i.e. 50Hz commutation frequency) is found to be best suited for 0.75 HP 1500-rpm motors designed for 13 mm outer diameter and 51mm axial length, drawing 1.132A current per phase.