Abstract

Permanent magnet machines are finding increased applications in electric vehicles as the cost of the oil products are on the rise and also there is pollution problem. The main feature of this type of machines is the compactness of their size compared with the normal machines. These type of machines are more efficient because of the fact that field excitation losses are eliminated resulting in significant rotor loss reduction. Thus, the motor efficiency is greatly improved and higher power density is achieved. PM motors are compact and suitable for some special applications where there is space and weight limitation.

PM machines are of two types: radial flux and axial flux machines. In the axial flux machine, the airgap is axial and the active current carrying conductors are radially positioned. The axial flux machines can be designed to have a higher power-to-weight ratio resulting in less core material and lower inertia. The adjustment of airgap is simpler in case of axial flux PM machines. The direction of the main airgap flux can be varied and many discrete topologies can be derived. Axial flux PM machines are smaller in size and have disc shaped rotor and stator structures.

The objective of this thesis is to develop a design method for axial-flux machine used for certain applications like electric vehicles, propulsion purpose in naval ships etc. The calculations have been presented for two types of axial-flux machines. (i.e. internal rotor machine and the other internal stator machine). As the internal rotor machine is compact as compared to the internal stator machine, the design process has been presented for the internal rotor machine.

The software tools like MATLAB, AUTOCAD and MAGNET have been used extensively to develop the design method for the axial flux machines. Axial flux permanent magnet machine parameters have been finalized by programming the calculation method using MATLAB software. The models developed are simulated using MAGNET software and the flux densities in various parts have been verified.