

Characteristics of Double-Stator Inner-Rotor Axial Flux Permanent Magnet Machine with Rotor Eccentricity

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Abstract : Axial Flux Permanent Magnet (AFPM) machines have been widely used in various applications due to their important merits, such as compact structure, high efficiency and high torque density. This paper presents one of the most important characteristics in the design process of the AFPM device, which is a recent issue. To design AFPM machine, the predicting electromagnetic forces between the permanent magnets and stator is important. Because of the magnitude of electromagnetic force affects many characteristics such as machine size, noise, vibration, and quality of output power. Theoretically, this force is canceled by the equilibrium of force when it is in the middle of the gap, but it is inevitable to deviate due to manufacturing problems in actual machine. Such as large scale wind generator, because of the huge attractive force between rotor and stator disks, this is more serious in getting large power applications such as large. This paper represents the characteristics of Double-Stator Inner -Rotor AFPM machines when it has rotor eccentricity. And, unbalanced air-gap and inclined air-gap condition which is caused by rotor offset and tilt in a double-stator single inner-rotor AFPM machine are each studied in electromagnetic and mechanical aspects. The output voltage and cogging torque under un-normal air-gap condition of AF machines are firstly calculated using a combined analytical and numerical methods, followed by a structure analysis to study the effect to mechanical stress, deformation and bending forces on bearings. Results and conclusions given in this paper are instructive for the successful development of AFPM machines.

Keywords : axial flux permanent magnet machine, inclined air gap, unbalanced air gap, rotor eccentricity

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