DESIGN OF A SINGLE-PHASE RADIAL FLUX PERMANENT MAGNET GENERATOR WITH VARIATION OF THE STATOR DIAMETER

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Abstract	This study aims to observe the influence of the changing stator dimension on the air gap magnetic flux density (B-g) in the design of a single-phase radial flux permanent magnet generator (RFPMG). The changes in stator dimension were carried out by using three different wire diameters as stator wire, namely, AWG 14 (d = 1.63 mm), AWG 15 (d = 1.45 mm) and AWG 16 (d = 1.29 mm). The dimension of the width of the stator teeth (W-ts) was fixed such that a larger stator wire diameter will require a larger stator outside diameter (D-so). By fixing the dimensions of the rotor, permanent magnet, air gap (I-g) and stator inner diameter, the magnitude of the magnetic flux density in the air gap (B-g) can be determined. This flux density was used to calculate the phase back electromotive force (E-ph). The terminal phase voltage (V-phi) was determined after calculating the stator wire impedance (Z) with a constant current of 3.63 A. The study method was conducted by determining the design parameters, calculating the design variables, designing the generator dimensions using AutoCad ana determining the magnetic flux ae,nsity using FEMM simulation. The results show that the magnetic flux density in the air gap and the phase back emf E-ph slightly decrease with increasing stator dimension because of increasing reluctance. However, the voltage drop is more dominant when the stator coil wire diameter is smaller. Thus, a larger diameter of the stator wire would allow terminal phase voltage (V-phi) to become slightly larger. With a stator wire diameter of 1.29, 1.45 and 1.63 mm, the impedance values of the stator wire (Z) were 9.52746, 9.23581 and 9.06421 Omega and the terminal phase voltages (V-phi) were 220.73, 221.57 and 222.80 V, respectively. Increasing the power capacity (S) in the RFPMG design by increasing the diameter (d) of the stator wire will cause a significant increase in the percentage of the stator maximum current carrying capacity wire but the decrease in stator wire impedance is not significant. Thus, it will reduce the phase terminal voltage (V-phi) from its nominal value.
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