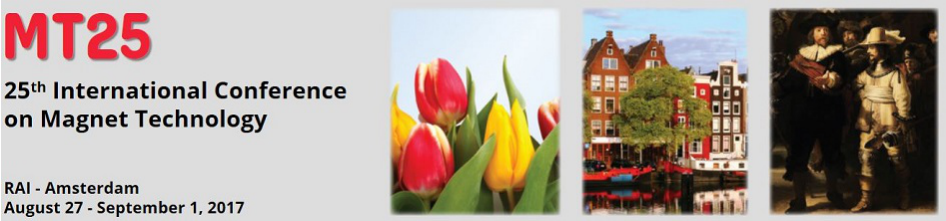

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Research on an Asymmetric-primary Hybrid-excitation Maglev Axis-flux Generator for the Vertical Axis wind Turbine

Thursday, 31 August 2017 13:45 (1h 45m)

The floating wind power generation is an important trend of the wind power generation on the sea, paid more attentions by the researchers around the world. The direct-drive vertical axis wind turbines (DVAWT) gives an important development direction for the floating wind power generation. In order to improve the starting performance and output power of the DVAWT, a hybrid excitation maglev axial-flux generator with asymmetric primary is proposed in this. Two-sided asymmetric primary is adopted to obtain maglev force and improve the starting performance, and hybrid excitation is used to adjust the suspension force and output power in real time for the stable output. Firstly, the operation principle of the proposed hybrid excitation maglev axial-flux generator is introduced, and the magnetic field distribution is analyzed by using 3D finite element method (FEM). The cogging torque produced by the teeth-slot effect between stator and mover may cause the mechanical vibration and ripple of electromagnetic force. Two axial-flux generators with different pole slot ratio are optimized and compared. In addition, the parameters in the static or the dynamic state are calculated and studied, and the laws of the parameters effecting the motor performance are grasped, and the optimizing method to weaken the cogging torque are obtained. Secondary, the levitation force is obtained and analyzed under different primary currents. Based on the on-load performance, a hybrid excitation method is proposed and is compared with only PM working. Lastly, considering the levitation force and output power, coordinated strategy of primary armature current and excitation current is proposed. By using 3D FEM, the output voltage, out power and voltage-regulation factor under different wind speed are obtained and analyzed. All the results show the proposed generator has advantages of Stable levitation force, controlled power, low voltage-regulation factor, and is well suit for vertical axis wind turbine.

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