

Wind Turbines Optimization: Shield Structure for a High Wind Speed Conditions

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Abstract : Optimization of horizontal axis semi-exposed wind turbine has been performed using a shield protection that automatically protects the generator shaft at extreme wind speeds from over speeding, mechanical damage and continues generating electricity during the high wind speed conditions. A semi-exposed to wind generator has been designed and its structure has been described in this paper. The simplified point-force dynamic load model on the blades has been derived for normal and extreme wind conditions with and without shield involvement. Numerical simulation has been conducted at different values of wind speed to study the efficiency of shield application. The obtained results show that the maximum power generated by the wind turbine with shield does not exceed approximately the rated value of the generator, where shield serves as an automatic break for extreme wind speed values of 15 m/sec and above. Meantime the wind turbine without shield produced a power that is much larger than the rated value. The optimized horizontal axis semi-exposed wind turbine with shield protection is suitable for low and medium power generation when installed on the roofs of high rise buildings for harvesting wind energy. Wind shield works automatically with no power consumption. The structure of the generator with the protection, math simulation of kinematics and dynamics of power generation has been described in details in this paper.

Keywords : renewable energy, wind turbine, wind turbine optimization, high wind speed

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