Application of a synchronous generator with a boost converter in wind turbines: an experimental overview

An electrical structure of a variable-speed wind turbine based on an externally excited synchronous generator; a passive diode rectifier; and a boost converter is discussed in this study. The clear advantage of such a system is its lower-semiconductor devices count. A brief theoretical explanation of such a system is included. A boost converter normally utilizes an inductor (energy storage) to boost the voltage level from its input to a higher output value. This study analyses the possibility of using the generator inductance as a boost inductor. It is discussed and verified in the study that for the given switching frequency of the boost converter (fs=1 kHz), the generator sub-transient inductance (not the synchronous inductance) appears as an equivalent inductance seen by the boost converter. The parasitic capacitors present in the generator terminals are often neglected from design issues. It is presented in the study that such capacitors can be a major issue when high-frequency switching is applied to the voltage at the generator terminals. Some major results from the experimental work are included. The experimental setup used in this work is a scaled down 7.5= kVA system.

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