Direct Power Control for Doubly-Fed Induction Generator Using Indirect Matrix Converters

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Abstract
In this paper a novel DPC strategy for Doubly-Fed Induction Generation (DFIG) based wind energy generation system with Indirect Matrix Converter (IMC) is proposed. The DPC with IMC deals with several main characteristics which makes it very suitable for DFIG. By suitably selecting switching pattern, the strategy is able to improve the steady state and transient response behaviors of the machine. This paper investigates the use of four-step commutation in rectifier stage of indirect matrix converters to reduce losses and input currents waveform distortion caused by circuit snubber. Using this proposed strategy, the advantages of the DPC schemes and the benefits of the indirect matrix converters can be combined. it will be shown that by use appropriate indirect space vector modulation in IMC the harmonics are reduced considerably. Simulation results of a 2 MW DFIG system demonstrate the effectiveness of the proposed control strategy during variations of active and reactive power.

1. INTRODUCTION
Nowadays, Doubly Fed Induction Generator (DFIG), in which the stator winding is directly connected to the network and the rotor winding is connected to the network through a converter is considered as the best option for many variable-speed wind turbine manufacturers [1]. The most important advantages of the variable speed wind turbines as compared with conventional constant speed system are the improved dynamic behavior, resulting in the reduction of the drive train mechanical stress and electrical power fluctuation, and also the increase of power capture [2]. Between all Doubly Fed Induction Machine (DFIM) control methods, direct control because of high dynamic performance is more known than others. These direct control techniques, are based on a direct control of the torque and flux magnitudes for the case of the Direct Torque Control (DTC), or on a direct control of the stator active and reactive power, for the case of the Direct Power Control (DPC) [3].
Several researchers on their efforts have focused on the progress DPC techniques that operate at a variable switching frequency [4,5]. Expensive and complicated ac harmonic filters and power converters, is the consequence of using the variable frequency switching. More recently in [6,7] DPC at constant switching frequency have been