Review of Power Control of Distorted Grid Voltage for doubly Fed Induction Generator

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Abstract— The electrical power generated by the wind system is one of the most reliable, efficient and developed renewable energy sources. Doubly fed induction (DFIG) based wind farm is today the most widely used concept. This paper reviewed and studied about dynamic modeling and control of doubly fed induction (DFIG) based on the wind turbine systems. Many researcher's/Author's perform different work as well as analysis based on Power Control of Distorted Grid Voltage for Doubly fed Induction Generator The dynamic performance of doubly fed induction generator is under various operating conditions like stability, grid voltage distortion as well as without distortion are studied . In this paper review about direct power control (DPC) strategy for doubly fed induction generator (DFIG)-based wind power generation system under distorted grid voltage and without distortion grid voltage. Harmonic component analysis of electrical grid is also studied through different literature survey.

Keywords: Doubly fed induction generator (DFIG), Direct Power Control (DPC) and Harmonic Analysis

I. INTRODUCTION

DFIG has been commonly used in wind power generation due to the advantage of low rating of power-electronics circuits needed to independently control of active and reactive powers delivered to the grid [1]. The basic theory and working principles of self-excitation in induction machines has been known for a long time [2]. The Doubly-Fed Induction Generator (DFIG) is an induction generator with both stator and rotor windings. The DFIG is nowadays widely used in variable-speed wind energy applications with a static converter connected between the stator and rotor [3]. Doubly-fed induction generator (DFIG) has gained increasing popularity due to several advantages, including smaller converters rating around 30% of the generator rating, variable speed and four quadrants active and reactive power operation capabilities, lower converter cost, and power losses compared with the fixed-speed induction generators or synchronous generators with full-sized converters.

II. DOUBLY FED INDUCTION GENERATOR

The use of doubly fed induction generator is increased as increase in use of wind power generation in India. An induction generator produces electrical power when its rotor is turned faster than the synchronous speed. In normal motor operation, the stator flux rotation is faster than the rotor rotation. A Doubly Fed Induction generator as its name suggests is a 3 phase induction generator where both the rotor and stator windings are fed with 3 phase AC signal. It also consists of a multiphase slip ring assembly to transfer power to the rotor. It is typically used to generate electricity in wind turbine generators.

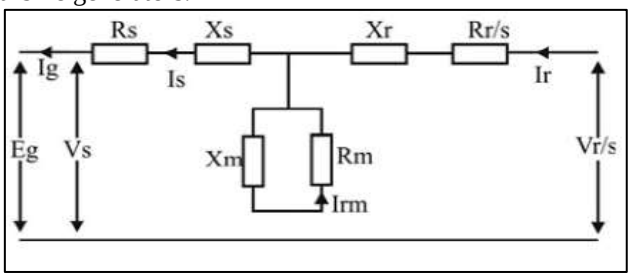

Fig. 1: Equivalent circuit of doubly fed induction generator

III. DIRECT POWER CONTROL

The power penetration from the DFIG-based wind turbines into the grid is increasing steadily, the control and operation of DFIG under grid disturbances has become the subject of intense research during the last few years. Direct control (DTC and DPC) presents some disadvantages, among which large torque/flux (active/reactive power) ripples and variable switching frequency are the two most notable drawbacks. Two different kinds of resonant current regulators for a doubly fed induction generator (DFIG) under distorted grid voltage conditions: proportional integral resonant (PIR) regulator with traditional resonant part and vector proportional integral (VPI) regulator with VPI resonant part. To control induction generator, several methods are used: electrically vector control [4], active and reactive power control [5], direct torque control [6], direct power control [7], variable structure or sliding mode control [8], passivity control, and mechanical (pitch, stall, and active stall control, yaw control, flywheel storage).

IV. LITERATURE SURVEY

Research groundwork is depends on literature investigation. Based on the studies carried out by several researchers and their contribution to research field motivates for future scopes of research. So various researchers' was work on slip ring induction generator, direct power control method as well as electrical power grid which are described through below summary.

Sr. No.	Author's Name	Converter	Method/Techniques	Performance
1	Heng Nian, Yipeng Song	VPI-based	DPC for DFIG	Suppress the power pulsation
2	Alireza Nazari, Hossein Heydari	Converter and Filter Design	RF-DPC, SF-DPC for DFIG	Improved dynamic and transient performance

3	Preeti V. Hazare, Shraddha S. Wairagade	VPI-based	DPC strategy for DFIG	Excellent disturbance rejection ability
4	Y. Djeriri et al		MPPT strategy for DFIG	Control active and reactive power
5	Jiabing Hu et al	RSC and GSC , PI–R current regulator	DFIG-based wind power system	Eliminating torque Total generated active power oscillations

V. CONCLUSION

New configurations for power control system of the doubly-fed wound rotor induction generator have been proposed. These configurations are based on a power control method using a rotating reference frame fixed on the air-gap flux of the generator. The active and reactive power of generator can be controlled independently and stably. Power and current control that are fundamental subjects have been analyzed. A VPI-based DPC strategy for a wind turbine driven DFIG system under the harmonically distorted grid voltage which suppress the power pulsation component, it can successfully implement the smooth active and reactive power output of DFIG under the harmonic voltage is reviewed through survey.

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