

# Analysis of Constant Control of The Power of DFIG Wind Turbines

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**Abstract** - Now days wind power energy is playing a major role in the power industry. With the increase in the application of wind power variety of new topologies are coming into the picture. Along with the unusual form of uneven speed fixed frequency topologies, DFIG is nearly all accepted due to its efficiency and capability to consent to a wide range of speed variations at reduced converter size. Doubly Fed Induction Generator (DFIG) is a wound rotor induction generator used to feed power from stator and rotor circuits. The rotor circuit is connected to a bidirectional ac to dc to ac converter with a common dc link bus. In the rotor, power flow is bidirectional, i.e., Depending on the mode of procedure, the power flow is from the rotor side to the grid, or it may be from the grid side to the rotor. The rotor region converter also fed reactive power to DFIG to run close to the unity power factor. The purpose of the grid voltage converter is to sustain the DC link voltage unvarying, which eventually feeds an unvarying amplitude ac voltage to the rotor side to keep the flux unvarying. But as soon as grid voltage disparity occurs, the DC link voltage also varies. Eventually, rotor input voltage varies because this causes irregular input of reactive power to the rotor circuit. So, to preserve the reactive power demand of the machine, it draws reactive power from the grid, which may lead to voltage variation at PCC. One result of this difficulty can be the compensation of grid voltage disparity before the grid converter circuit.

Keywords—DFIG, PCC, DVR, Voltage Sag, WECS.

## 1. INTRODUCTION

A few decades before, most of the research in power systems was developing conventional energy-based power generation. However, the issues similar to the global oil predicament, restricted accessibility of conventional sources, and environmental pollution effect forced the researcher to think about an alternative energy source that can solve the above issues. Renewable energy sources like wind energy, solar energy, tidal energy can be a possible resolution. Renewable energy is consequent from natural processes that are replenished frequently. All these sources are plentifully available in nature, recyclable, and almost available free of cost. As an alternative to fossil fuels (such as coal and natural gas), wind power is available abundantly, renewable, broadly spread, fresh, produces zero greenhouse gas throughout the maneuver, and uses little land for its set up. This tool is not novel to human beings. For more than two

millennia, wind-powered machines have ground grain and pumped water. It was the year 1887 when wind power was first time used for producing electricity. After that, wind energy was used to produce power on a small scale. The year 1973, when the oil price crisis accelerated the investigation of non-petroleum energy, researchers started researching wind-based power generation for bulk use. According to the report Energy Statistics 2013, the total installed capacity of wind power generation in India as of 31.03.2012 is estimated to be 49130MW which is around 54.73% of the total installed renewable energy capacity.

## 2. LITERATURE SURVEY

Dekhane [6] Nowadays, the most currently installed variable speed wind turbines are based on doubly fed induction generators. This article reviewed the objectives and the techniques used to control an onshore horizontal axis wind turbine. We develop the model for the simulation and the analysis of a double-fed induction generator. To facilitate the electrical production control, the separated control of active and reactive powers of such as machine is considered. The results of simulations realized under the MATLAB/Simulink software are analyzed and interpreted. Muller[7] shows that adjustable speed generators for wind turbines are necessary when output power becomes higher than 1 MW. The doubly-fed induction generator (DFIG) system presented in this article offers many advantages to reduce cost and has the potential to be built economically at power levels above 1.5 MW, e.g., for off-shore applications. A dynamic model of the DFIG was derived from developing a vector controller to decouple dynamically active and reactive power control. Simulations show the excellent response of the DFIG independent of speed. Measurements obtained from 1.5 MW units currently in operation confirm the theoretical results. Mannah[8] represents the increasing environmental concern; more and more electricity is generated from renewable sources. Wind power is one of the most reliable renewable energy sources in the 21st century and helps meet the national energy demand when there is a diminishing trend in terms of non-renewable resources. The performance and efficiency of any wind energy conversion system (WECS) depend upon the characteristics of the components constituting it. One of the most predominant WECS in literature consists of a doubly-fed induction generator (DFIG) and a unidirectional power converter controlled by a vector

control strategy. Ling-ling [9] The linearized model of a single-machine infinite bus power system integrated with DFIG is derived. According to the linearized model, the figure of the Phillips-Heffron model can be drawn. For a single machine infinite bus system with DFIG integrated, the damping torque of the electromechanical circuit of the synchronous generator (SG) comes from two parts: one part is the synchronous generator's excitation winding and automatic voltage controller (AVR), the other part is DFIG. Liu [10] The rotor of a doubly-fed induction generator (DFIG) is connected to the grid through converters, and the active power can be regulated by controlling the converters.

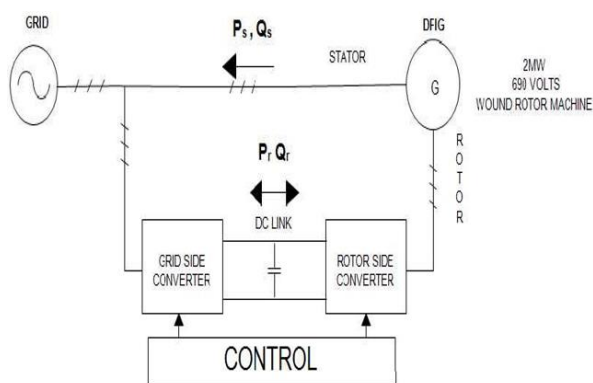


Figure 1. Basic Configuration of Doubly-Fed Induction Generator (DFIG)

Thus, DFIG can quickly respond to frequency fluctuations with virtual inertial control, releasing kinetic energy stored in rotors. Dong [11] represents For sub-synchronous resonance (SSR) phenomenon in the doubly-fed induction generator (DFIG)-based wind farm and series compensated transmission network. This paper firstly studies SSR characteristics in all DFIG operation areas, including maximum-power-point-tracking (MPPT), constant rotation speed per area, and limiting output power per area, to obtain SSR-stable area with the finding that SSR characteristics vary in different operation areas.

**3. PROBLEM STATEMENT**

Study the basic DFIG scheme and analysis of the Grid converter control scheme and the effect of voltage disturbances on the grid converter. Study of Voltage Sag mitigation scheme. Study of energy storage device for wind power application.

**4. PROPOSED ALGORITHM**

When a DFIG is connected to the grid and supplying power, many issues come into the picture, which may affect the working of this generator. The measure issues are sudden wind gusts, grid abnormalities such as voltage sags, swells, frequency variation. The effect of wind gusts could probably be seen as the stator frequency and voltage fluctuation. But DFIG is quite

able to handle this problem by adjusting the frequency of the rotor injected source. Along with the DFIG converter. The turbine control schemes like pitch control scheme, Yaw control are used to compensate for these fluctuations up to some extent. But what about grid abnormalities? Grid abnormalities can lead to serious problems like torque pulsation, reactive power pulsation, abnormal current and mechanical stress on the generator, gearbox, and sometimes also on the wind turbine. So, the major question is how to control DFIG based wind generation during grid abnormalities. This problem encourages me to choose this issue as my research objective.

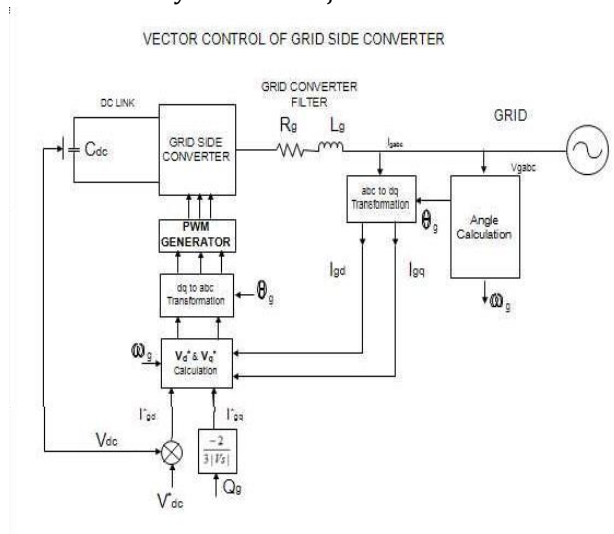


Figure 2 Grid converter scheme

**5. RESULT AND ANALYSIS**

A grid converter is typically a three-phase, two-level voltage source converter which uses IGBT as a switching device. As discussed earlier, the main purpose of grid side converter control is to regulate the DC link voltage by implementing a grid voltage-oriented control scheme.

**6. CONCLUSION**

Z-source overcomes the conceptual and theoretical barriers and limitations of the traditional voltage-source converter and current-source converter. Z-source inverter can boost-buck voltage, minimize component count, increase efficiency, and reduce cost. The Z-source concept can be easily applied to adjustable-speed drive (ASD) systems.

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