# ACTIVE AND REACTIVE POWER CONTROL OF DFIG BASED ON WIND ENERGY SYSTEM

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***Abstract*—Wind energy conversion systems have become a focal point in the research of renewable energy sources. The purpose of this paper is deals with the design, analysis of a wind turbine associated with a storage unit to generate a constant active power through the grid for all wind conditions. As the increase in energy demand the usage of wind turbine system (WTS) has increased.A Doubly Fed Induction Generator (DFIG) allowing a large speed variation and a large range of wind is employed. Active power and reactive power control of the DFIG are based on the feedback technique by using the suitable voltage vectors on the rotor side.The many different generator–converter, both the combinations are compared on the basis of topology, cost, efficiency, power consumption and control complexity. The rotor flux has no impact on the changes of the stator active and reactive power. The proposed controller is based on the feedback technique in order to reduce the oscillation of the generator. The control approach is estimated through the simulation result of the feedback controller assembled with DFIG wind turbines.Thefeedback control based techniques in order to control the power flowing of DFIG and the power grid. Hence, an improved feedback control technique is adopted to get a better power.**

## I. INTRODUCTION

Wind power as a potentially available free energy resource it has a rapid growth in the world. A wind turbine system (WTS) transforms kinetic energy into electrical energy and it mainly consists of an aero-turbine, which converts wind energy into mechanical energy. There are different ways to reduce the operation investments in wind energy conversion systems. One of them is to make an effective capture of energy from the wind utilizing effective control strategies. The contributions of these studies include new control structures, even for the aero-turbine mechanical part and the electrical components that overcome some of the drawbacks of existing control methods. Another efficient way to reduce cost of a WTS is through optimal wind farm planning and predictive maintenance. The main objective of optimal wind farm planning includes wind farm site selection and layout design to minimize the cost of energy and to maximize the net energy production [1]

The stator is usually connected directly to the three-phase grid the rotor is also connected to the grid but via a transformer and two back-to-back converters. The electricity is produced from hydropower, solar energy, the wind energy and geothermal energy, tides, waves and biomass energy sources etc., to produce an electricity much attention is given for the above energy sources. For the growth of the wind energy, energy sources is considered to be the decisive input. Usually, the rotor-side converter (RSC) controls the active and reactive power and the grid side converter (GSC) controls the DC-link voltage. Through wind energy, can able to produce electricity. DFIG is commonly used for the production of electricity because of its numerous advantages over its counterparts. In the DFIG concept, the stator is usually connected directly to the three-phase grid, the rotor is also connected to the grid but via a transformer and two back-to-back converters. The arrangement which provides flexibility of operation in sub-synchronous and super-synchronous speeds in both generating and motoring modes [2]

Power which is produced from wind energy, this power contributes a significant proportion of consumers' electrical power demands. This obtained power is with low cost, no fuel cost and having high efficiency. For example, 20% of the entire electricity consumption in Denmark is provided by wind energy. The use of power electronic converters allows for variable speed operation of the wind turbine, and also this converter control the variation of wind speed. It enhanced power extraction. In variable speed operation, a control method designed to extract maximum power from the turbine and provide constant grid voltage and frequency is required [3]

As the wind power penetration continually increases, power utilities concerns are shifting which is focus from the power quality issue to the stability problem which is caused by the wind power connection. Many variable speed concepts, the DFIG equipped wind turbine has many advantages over others. For example, in wind turbine system the power converter only deals with rotor power, therefore the converter rating can be kept fairly low, approximately 20% of the total machine power [4].

## II. DOUBLY FED INDUCTION GENERATOR

Doubly fed induction generator (DFIG), it is a popular wind turbine (WT) system due to its high energy efficiency which reduces mechanical stress on the wind turbine, and relatively having low power rating of the connected power electronics converter of low costs. The controllability of the rotor side converter with respect to the active and reactive power of the DFIG is temporarily lost. . For the grid side control scheme, a compensation item, which controls the variation of the DC-link current of the rotor side converter and also its controls the DC link voltages, hence the DC link current is added during the fault to smooth the fluctuations of the DC-link voltage [5]

Most important is that rotor side converter has lower power rating, this rotor side converter which decoupled with stator side active and reactive power control (i.e. power factor control from stator side), which has lesser power factor control from rotor side. In the DFIG concept, stator is directly connected to the three phase ac supply grid and the rotor side slip ring terminals are connected to the same ac mains via pulse width modulated dual converter In this study, we proposed a controller through feedback technique for DFIG transient stability analysis in order to obtain accurate results and simulation on the basis of well-known tool Mat-lab. It is well known that the transient stability analysis under the typical situation which is dominated by conventional synchronous generators [6]

In order to control the active and reactive power exchanged between the machine stator and the grid, the rotor is fed by a bi-directional converter. This device is used to be implemented in a variable-speed wind-energy conversion system connected to the grid. The DFIG is controlled by standard relay controllers. using Simulink in MAT-LAB we can obtain details of the control strategy and system simulation were performed and the results are presented in this, here to show the effectiveness of the proposed control strategy. The doubly fed induction generator (DFIG) is widely used for Variable-speed generation and it is one of the most important generators for wind energy conversion systems. Both grid connected and stand-alone operation is feasible [7].

In recent years, the electrical power generation from renewable energy sources, such as wind energy, is increasingly attraction interest because of environmental problem and shortage of traditional energy source in the near future. This paper deals with permanent magnet synchronous generator (PMSG) based on wind energy conversion system (WECS) combined with grid with two back to back connected converters with a common DC link. The main purpose of this research is to model control the wind turbine permanent magnetic synchronous generator (PMSG) which is direct driven 1.5 MW which feeds alternating current (AC) power to the utility grid. Nowadays, production of electricity from the wind on a large scale became a recognized industry. It holds great potential showing that in the future will become the undisputed number one choice form of renewable source of energy. The force that pushes this technology is the simple economics and clean energy [8]

Over past few decades on the different problems associated due to penetration of WT-DFIG in the power system. This can be studied as an overview and literature survey which control aspects of DFIG. Out of these resources wind energy conversion systems (WECS) becomes so much popular in the world. There are some other limiting factors related to other natural resources such as for solar energy costlier solar cell and long-lasting storage battery technologies, required large area for 1MW plant, after the some problem in atmospheric condition there is a problem in maintenance and to overcome this they need more man power. [9]

## III.METHODOLOGY

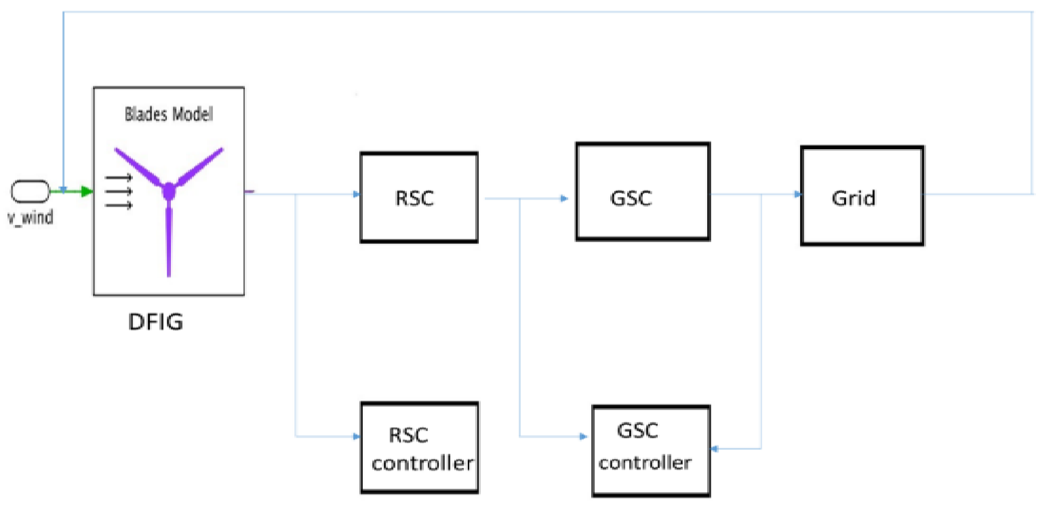


Fig. Schematic Diagram of wind energy based on DFIG System

The schematic diagram of wind energy based on DFIG system is as shown in above figure. . The DFIG WT system, including the wind turbine, the induction generator, the back-to-back PWM converters, and the control system, this control system is connected to the grid through a transformer. The wind turbine is connected to the induction generator through a mechanical shaft system, which consists of a low-speed shaft and a high-speed shaft and a gearbox in between. The control system consists of two control levels including the WT control and the DFIG control. The WT level controls the output, mechanical power of the wind turbine through the pitch angle and generates the reference value for the rotor speed of the DFIG. The DFIG control level, including the rotor and grid side controllers, is to control the active and reactive power of the DFIG using the vector control technique. The stator is directly connected to the grid. In the DFIG concept, the stator is usually connected directly to the three-phase grid; the rotor is also connected to the grid but via a transformer and two back-to-back converters. Usually, the rotor-side converter (RSC) controls the active and reactive power and the grid side converter (GSC) controls the DC-link voltage and ensures operation of the converter at a unity power factor. The power flow between the rotor circuit and the grid must be controlled both in magnitude and in direction. The active and reactive power are estimated using current measurements. So that in this decoupled control between the active and reactive power is obtained. The objective of the RSC is to govern both the stator-side active and reactive powers independently; while the objective of the GSC is to keep the dc-link voltage constant regardless of the magnitude and direction of the rotor power. The GSC control scheme can also be designed to regulate the reactive power. The reactive power control by the RSC and GSC is necessary to keep the voltage within the desired range, when the DFIG feeds into a weak power system with insufficient local reactive compensation. The wind turbine controller controls the pitch angle of the blades, which determine the mechanical power that the turbine extracts from the wind. The arrangement provides flexibility of operation in sub-synchronous and super-synchronous speeds in both generating and motoring modes. The power inverter needs to handle a fraction of the total power to achieve full control of the generator

## IV. CONCLUSION

All control methods described in this paper, this control method is to obtain maximum energy transfer from the wind turbine to the grid. In this study, describing a new method for finding the turbine output power with a variable speed of wind turbine system [WTS] was obtained. To design the WTS to make the effective performance of WT was proposed by a frame work. Characteristics of wind and some features of the site based on the cost. If it is less cost this can be taken into account. The Various parameters such as rotor diameter, hub height, power ratings of generator, and the rated speed of wind that indicate the performance of WTS were used as design parameters. An emperial formula is used to describe the relation between the hub height and rotor diameter, in order to increase the reliability and computational efficiency of WTS. Due to this, significantly improves the performance of WTS. The proposed method of the feedback controller for the DFIG wind turbine is obtained by the maximum power

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