# SIMULATION OF WIND TURBINE WITH DFIG USINGPITCH ANGLE CONTROL

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**Abstract -** We are trying to reduce use of conventional energy resources by utilizing renewable energy resources. We are work on generation of wind energy effectively . we use DFIG (Doubly Fed Induction Generator) because it has the many advantage that is the separate or independent control of Active and Reactive power or to control of wind turbine power factor Dynamic behaviour of the wind turbine model can be by changing wind speed, pitch angle, load and inverter output parameters. We are try to use a pitch angle control method. Pitch angle control is the technology used to operate and control wind turbine blades angle. The system is in general either made up of electric motors and gears, or hydraulic cylinders and a power supply system. Pitch angle control method is the most popular technic for adjusting the aerodynamic pressure of the wind turbine and minimize aerodynamic risk when the wind speed is greater than its rated or set value. We use MATLAB/Simulink software for simulation .

***Key Words*:** Renewable Energy, Wind Turbine , DFIG, Pitch angle control, Power, MATLAB/Simulation

## 1.INTRODUCTION

Wind turbine generators are work based on synchronous generators (Fixed speed wind turbine) and adjustable/variable speed wind turbine like squirrel cage induction generator which requires capacitor bank for additional Volt Ampere Reactive (VAR) for its self operation and DFIG in which the slip power can be drawn out when there is high wind speed and power can be injected into the rotor from the grid when there is less wind speed which is minimum than the synchronous speed of the machine ,DFIG is a most used wind turbine generator in the field of wind energy conversion system as compared to fixed speed wind turbine generator hence it gives four-quadrant active and reactive power and operate in variable/changeable speed. It is cheaper than synchronous generators as it consists of less rated RSC and GSC . Therefore, DFIG based wind turbines are focused by many researchers for the development of grid connected renewable systems. In order to study the dynamics of DFIG, the mathematical modeling of grid connected DFIG systems is very much important. Dynamic equations of grid connected DFIG systems are dealt in various literatures The system comprises wind turbine, drive train, grid connected induction generator through transmission line . which is important to analyze the stability of the system.

Development of the whole system model such as model of wind turbine, drive train, grid connected induction generator with RSC and GSC are well explained in this paper. This simulation model can be used for stability analysis in future with control method. Based on the built model, dynamics of different rated DFIG based wind turbines are analyzed for balanced and unbalanced conditions which include rotor short circuit analysis, zero wind speed analysis and sudden grid voltage drop analysis and the paper discusses the simulation results of 3.73kW rated DFIG for high wind velocity.

## 2. LITERATURE SURVEY

[1] CH Chong, A R H Rigit and I Ali[1] , "Wind turbine modeling and simulation using MATLAB" June 2020, DOI: 10.1109/ICIEAM48468.2020.9112076. In this paper , modeling and simulation of wind energy conversion system (WESC) by using various generators operating the same frame work will be carried out using MATLAB to analyze the efficiency of the generators. In this the behavior of every generators with changed wind speed can be observed.

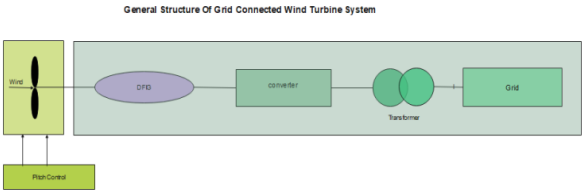
[2] Omessaad Elbeji, Marwa Hannachi,[2] "Pitch Angle Control of a Wind Turbine Conversion System at High Wind Speed" March2021,DOI:10.1109/SSD49366.2020.9364174 . From this paper we found how to control the blade pitch angle at high wind speed for the protect the wind turbine. The traditional method used is PI controller to control the pitch angle. To maintain the turbine power at high wind speed pitch angle control system. is used .This system also makes it possible to stop the turbine when the wind speed reaches its limits value.

[3] Seyfettin Vadi, Fethi Batincan Gurbuz, Ramzan Bayindir and Eklas Hossian, "Design and Simulation of a Grid Connected Wind Turbine with Permanent Magnet Synchronous Generator"July2022DOI:10.1109/icSmartGrid49881.2020.9144762. In this paper, a grid connected operations of wind turbine with permanent magnet synchronous generator (PMSG) this particular study is present. This paper help know the general structure of grid connected wind turbine system.

[4]Anvay , Hrishikesh , Jersan George[3],"Modeling and Simulation of Standalone Wind Energy Conversion System" Oct 2019, DOI: 10.1109/ICOEI.2019.8862682. From this paper we know With renewable energy sources available in abundance, it has become possible to harness and use this energy extensively. One such energy source is Wind. All information the modeling and simulation of standalone wind energy conversion system for small scale operations is given in this paper. It consists of Wind turbine Simulink model, DC generator and chopper followed by the load.

## 3. SYSTEM ARCHITECTURE

### 3.1 Block Diagram

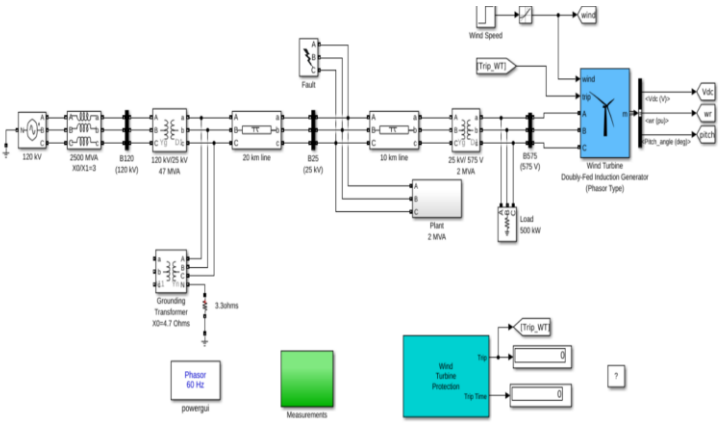



First of all wind turbine is a machine that converts wind's kinetic energy into mechanical energy. This mechanical energy is given to the DFIG( doubly fed induction generator) By adjusting pitch angle of wind turbine we achieve the variable speed .Then converter part which the power electronic interface control and rotor currents to accomplish the changeable speed needed for minimum energy capture in variable winds. Converter converts a same frequency Ac waveform to Ac waveform of a lower frequency. & gives to a transformer. Transformer is a device that transfers electric energy from one circuit to another for step up purposes & energy is supplied to grid.

### 3.2 Working

We are use a pitch angle control method in this for Speed control of a wind turbine. Pitch control method is nothing but Adjusting/changing the aerodynamic force of the wind turbine when speed of wind varies/change. This overall of pitch angle control is general either made up of electric motors and gears. The application of pitch angle control is to change the blade angle to fulfill certain rotor speeds or power output. Pitch angle adjustment is the successful way to limit output power by adjusting aerodynamic pressure on the blade at high wind speeds. Till now various methods have been used for modeling and controlling of grid inverter such as zero crossing method, filtering of grid voltages, and lastly, Phase Locked Loop (PLL) method..This information has been used as a reference in converting from DC voltage obtained from the wind turbine to AC voltage. The AC voltages signals converted from the grid signal and wind turbine have been provided voltage control by converting from Vabc fixed plane to Vdq rotary plane. Sinusoidal PWM parameters have been obtained by converting Vdq voltage in the rotating plane to Alpha-beta constant plane. Thus, the switching signals of the inverter have been generated according to the position of the grid signal and the grid signal has been monitored.

### 3.3 Simulation Diagram




Wind Power Plant (DFIG with Pitch Angle Control Method)

**Result of simulation**:

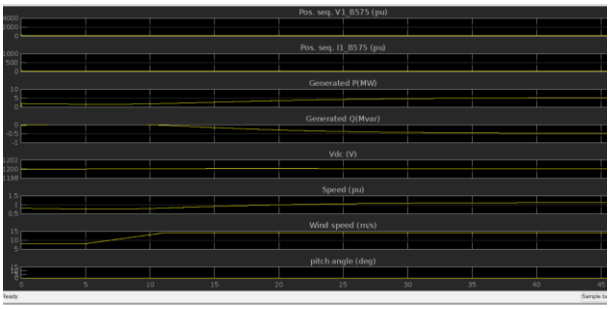



Fig. Result at wind side

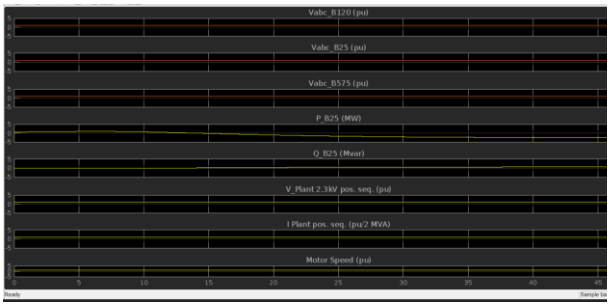



Fig. Result at grid side

## CONCLUSIONS

Complete simulation of wind turbine with Doubly Fed Induction Generator by use of pitch angle control is done , By varying pitch angle we control output power in such manner that if speed is greater than cutting speed then it turbine speed and output power become zero ,it reduce damage. When wind speed is equal to or below rated/set speed then pitch angle is control in such way that desired output power can be generated

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