

# Modeling and Analysis of Grid Connected Induction Generator for Wind Power Application

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**Abstract** – Over the once many decades, there has been an adding use of induction creator particularly in wind power operations. In creator operation, a high transport( turbine, machine) drives the rotor above the coetaneous speed. Stator flux still induces currents in the rotor, but since the opposing rotor flux is now cutting the stator coils, active current is produced in stator coils, and motor now operates as a creator, and sends power back to the electrical grid. As founded on the source of reactive power being produced induction creators can be subdivided into two types videlicet standalone creator and Grid connected induction creator. In case of standalone IGs the bewitching flux is established by a capacitor bank connected to the machine and in case of grid connection it draws bewitching current from the grid. This design explicitly deals with the study of grid connected induction creators where frequence and voltage of the machine will be mandated by the electric grid. Among these types of IGs, twice Fed Induction creator( DFIG) wind turbines are currently decreasingly used in large wind granges because of their capability to supply power at constant voltage and frequence. ultramodern control ways similar as Vector control and MFC( magnitude and frequence control) are studied and some of proposed systems are dissembled in MATLAB-SIMULINK terrain.

**Keywords-** electrical grid, generators, DFI

## I. INTRODUCTION

The energy sector is by far the biggest source of these emigrations, both in the India and encyclopedically, and if we're to attack climate change it's clear we need to move down from burning limited reactionary energy reserves to further sustainable and renewable sources of energy. Wind power has numerous advantages that make it a economic source of power for both mileage- scale and small, distributed power generation operations. The salutary characteristics of wind power include

- Clean and endless energy — Wind power does n't produce any emigrations and isn't run down with time. As per report it has been found that 1 megawatt wind turbine used for one time can displace over 1,500 tons of carbon dioxide in the environment, 6.5 tons of sulphur dioxides, 3.2 tons of nitrogen oxide, and 60 pounds of mercury into the environment.
- Original fiscal development — Wind shops can give a establishment inflow of income to coproprietors who lease their land for wind development, while adding property duty earnings for original communities.
- Modular and scalable technology — Wind operations can take numerous forms, including large wind granges, distributed generation, and single end- use systems. serviceability can use wind coffers tactically to help reduce cargo soothsaying pitfalls and trapped costs.
- Energy price stability — by farther diversifying the energy admixture, wind energy reduces dependence on

conventional energies that are subject to price and force insecurity.

Reduced dependence on imported energies — Wind energy expenditures don't need to gain energies from abroad, keeping finances closer to home, and lessening reliance on foreign governments that supply these energies.

## II. WIND ENERGY-GENERATING SYSTEMS

1. Mechanical Power transmitted to the shaft is

$$P_m = 0.5\rho C_p A V_\infty^3$$

Where

$C_p$  is a function of tip speed ratio (TSR) and pitch angle  $\alpha$   
For wind turbine with radius

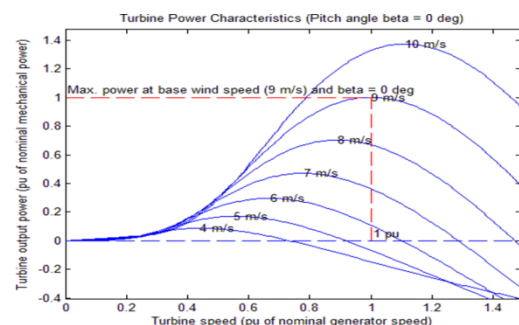


Fig: 1. Typical Power versus speed characteristics of a wind turbine

The above curves represents the relationship between existing mechanical power which is extracted from the wind and the rotor speed run at various wind speeds. For each wind speed there exist an optimum turbine speed at which provide opportunity for the maximum power extraction.

### III GRID CONNECTED INDUCTION GENERATOR

Grid connected induction generators have been developing their excitation from the Utility grid which is already present. The generated supply system when the IG is run above synchronous speed. Machines which have cage type rotor fixed feed only through the stator available and generally operate at low negative slip as described. But wound rotor machines can feed power through the stator as well as rotor to the bus over a wide range known as Doubly Fed Induction Machines.

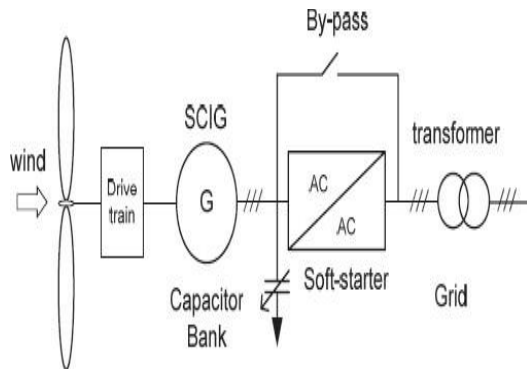


Fig 2: Fixed speed wind turbine with directly grid connected squirrel-cage induction generator

#### 1. Doubly Fed Induction Generator

Presently DFIG wind turbines are decreasingly used in large wind granges as shown in the figure below. The AC/DC/AC motor consists of two factors the rotor side motor  $C_{rotor}$  and Grid side motor  $C_{grid}$ . These transformers are voltage source transformers that use forced dicker power electronic bias( IGBTs) to synthesize AC voltage from DC voltage source. A capacitor which is used and connected on DC side will acts as a DC voltage source for serving the purpose of controlling the voltage. The creator slip rings are connected to the rotor side motor, which shares a DC link with the grid side motor in a so called back- to- back configuration. The wind power which is stored in the turbine is converted into electric power with the help of IG and is transferred to the existing grid by stator and rotor windings. The control system which is attached to provides the pitch angle command which can be used and the voltage commands for  $C_{rotor}$  and  $C_{grid}$  to control the power of the wind turbine under experiment, DC machine voltage and reactive power or voltage at grid out stations.

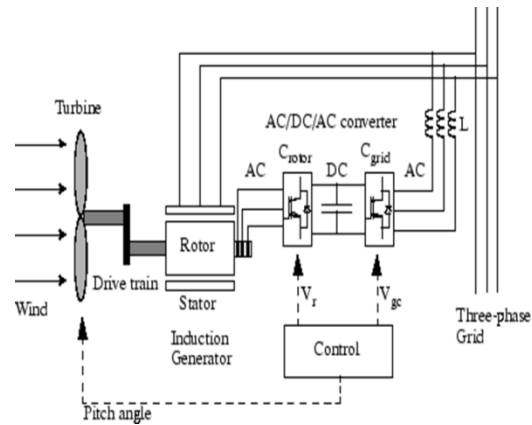


Fig 3: A DFIG and wind turbine system

### IV . RESULTS

#### 2. Pitch Control Analysis By Matlab

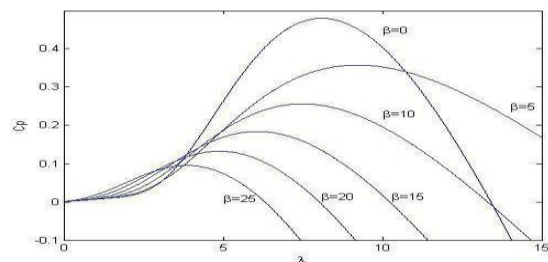


Fig 4. Power coefficients versus tip speed ratio

#### 2. Mechanical Characteristics Analysis By Matlab

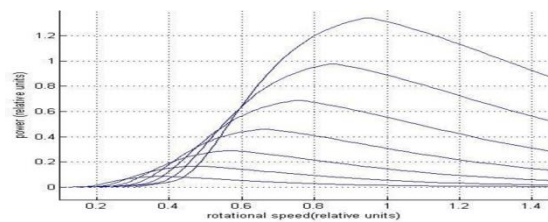


Fig 5. Wind turbine output power vs rotational speed, with wind speed as parameter

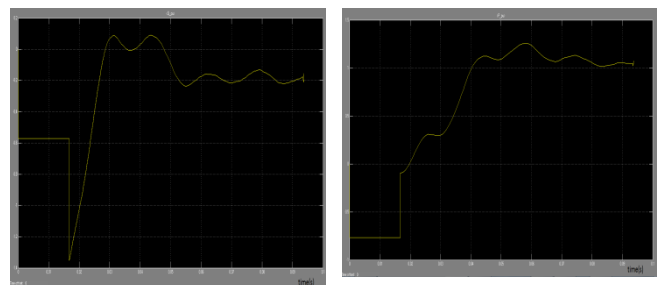


Fig: 6 Active Power

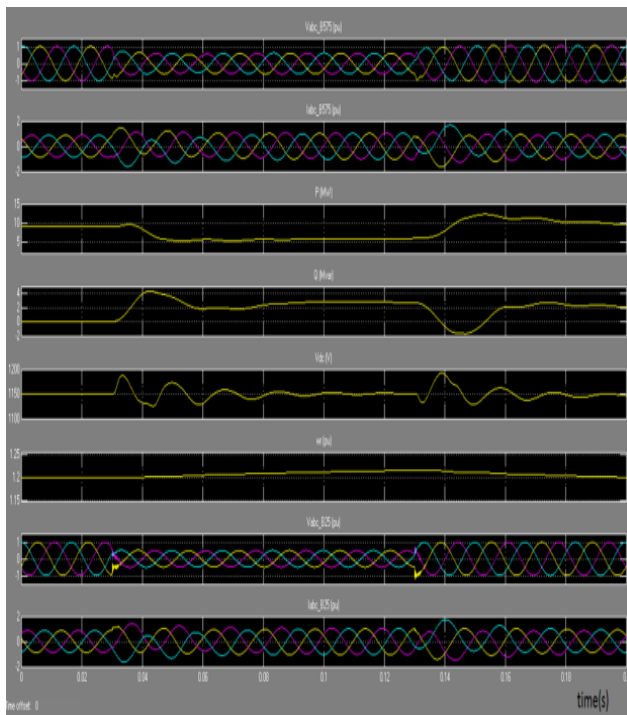


Fig: 7 Reactive Power.

## V. CONCLUSIONS

DFIGs are tremendously used in Wind granges because of their capability to supply power at constant voltage and frequency. Characteristics of DFIG are studied in MATLAB terrain. Control ways of DFIG have been analysed. During the research work, the Magnitude and frequency control of the generator has been studied and a Simulink model prepared as well as has been proposed for the same. Unlike traditional styles like Stator flux exposure vector control and FMAC, the MFC system manipulates the magnitude and frequency of the rotor voltage. This simplifies the design of the control system and improves system trustability.

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