IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

INVERTER BASED WIND TURBINE SYSTEM BY USING MAXIMUM POWER PONIT TRACKING (MPPT)

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Abstract— This paper focus on development of maximum power generation from the wind energy system. Recently, Maximum Power Point Tracking (MPPT) algorithms play an important role in optimizing the output obtained from the wind energy system. It is well known that wind speed varies; the power from the wind turbine changes accordingly. So, implementation of MPPT is necessary to keep output power at its maximum value with sudden change in either wind speed or load. The same dc energy will be fed to load with inverter and catch required load demand. PI controller-based inverter system is used to improve the power the power of wind energy system. The model considers the MPPT technique in order to extracting maximum possible power form the wind energy system based on permeant magnet synchronous generator (PMSG).

Keywords— Permeant Magnet Synchronous Generator (PMSG), Boost converter, three phase inverter, wind energy conversion system.

I. INTRODUCTION

The wind power generation is rapidly growing and the use of wind farms and other distributed power generation System have drastically increased. However, the generated power from the renewable energy source is always fluctuating due to environmental condition. The power quality becomes an issue when wind generators are connected to grid, due to the interaction between the grid and wind turbine.

In this project MPPT are use in order to extracting maximum possible power from the wind energy conversion system based on PMSG. There are different methods of MPPT to Impervo the generate wind energy. (HCS)Hill climb search control method is used in this project.

II. WIND ENERGY CONVERSION SYSTEM USING PMSG

shown in fig.1 the figure consists wind turbine, permeant magnet synchronos generators, diode bridge rectifier, boost converter, inverter and LC filter after then load. DC-DC boost converter are used voltage are increased. MPPT control singnal is given to the boost converter.the boost voltge signal going to inverter and after then load.

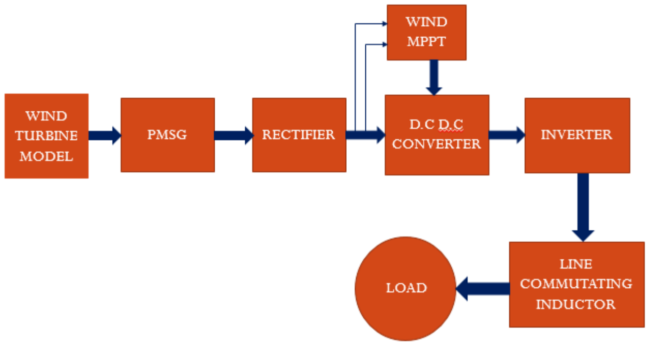

fig.1 block diagram

III. WIND TURBINE MODELING

Wind turbine converts to K.E of wind into mechanical energy by means of producing torque. The energy hold by the wind is in the from of kinetic energy. Wind power is developed by the turbine is given by,

$$P=0.5\ Cp\ (\beta, \lambda)\ \rho A v^3$$

Where,

P= Power generated by the wind turbine

A= Area swept out by the turbine blades

v= Wind seed

ρ= Air density

λ= Tip speed ratio

β= Pitch angle

Cp (λ, β) = Power coefficient

The wind turbine model designed in MATLAB. This block implements a variable pitch turbine model. A performance coefficient Cp of the turbine is that the mechanical output power of the turbine divided by wind power and a function of wind speed, rotational speed, and pitch angle.

Parameters of wind turbine are:

Power:8.5e3

Base wind speed(m/s):12

Base power of the electrical generator (VA):8.5e3/0.9

Max. power at base wind speed (p.u):0.8

Base rotational speed (p.u):1

Pitch angle:0

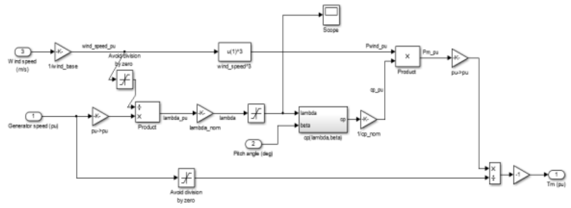

Fig.2 wind turbine model

IV. Boost converter

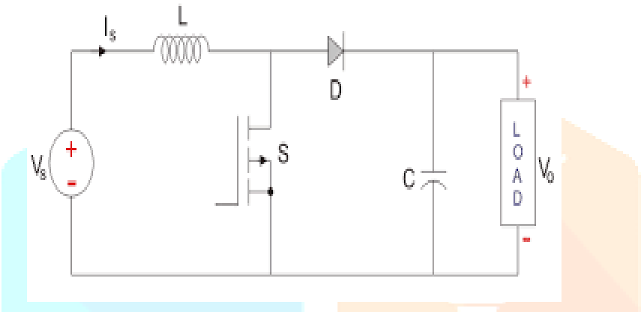

Fig. 3 Boost Converter

Show in fig3 Boost converter consist of voltage are input source, switch, inductor, diode, capacitor and resistor which is consider as a load. The switch can be open or closed depends on the output requirement. The output voltage across the load is always greater then input voltage. A boost converter is a step up the voltage. The output voltage of boost converter is deepened on duty cycle. The output voltage is given by,

$$Vo=Vs/(1-D)$$

Vo= output voltage of boost converter

Vs= input voltage of boost converter

D= duty cycle

V. Three phase inverter

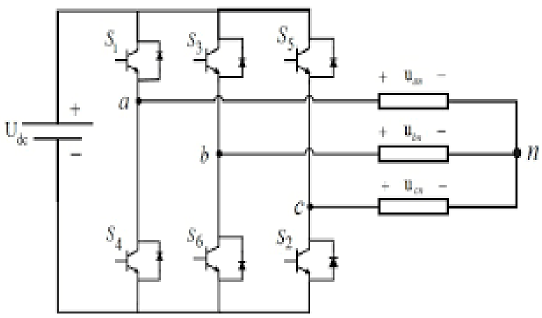

Fig.4 three phase inverter

Show in fig 4 inverter that converts DC to AC. Pulse width modulation (PWM) is a switching technique that is used to decrease the total harmonic distortion in to the inverter circuit. The output of the boost converter is go to a three-phase inverter which converts the constant DC to constant AC having a frequency of 50 Hz.

VI. Maximum power point tracking (MPPT)

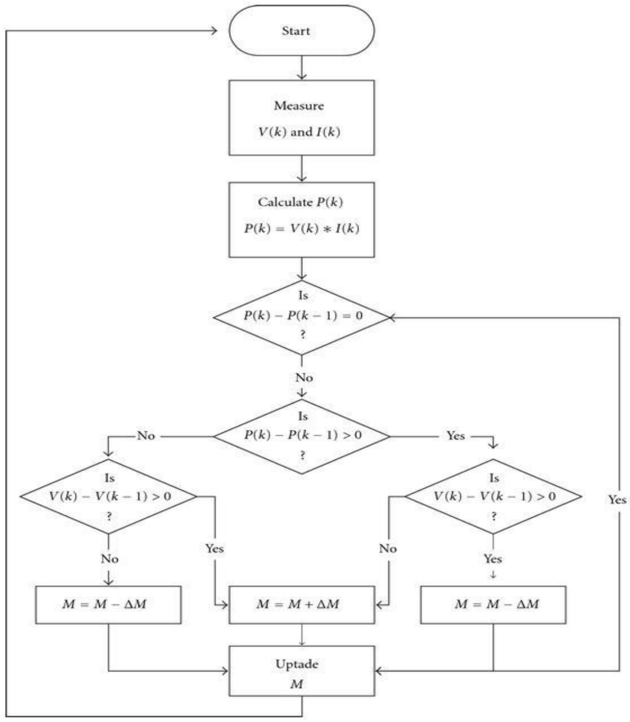

Fig.5 flow chat of Hill climb search control(HSC)

The HSC method is used in wind energy conversion system. This is simplest method of MPPT. In this method the power increase due to perturbation then the perturbation is continued in that direction. After the peak power is reached the power at to the next instant decrease and hence after then the perturbation reverses. when the peak point. In order to keep in to the power variation small, the perturb size is also small.

In this method determine the operating point of the wind turbine, it is essential to include a maximum power point tracking (MPPT).

Although there are many other methods of MPPT but HSC method is simplest and easy.

VII. Simulation and results

A. Complete SIMULATION model if proposed work

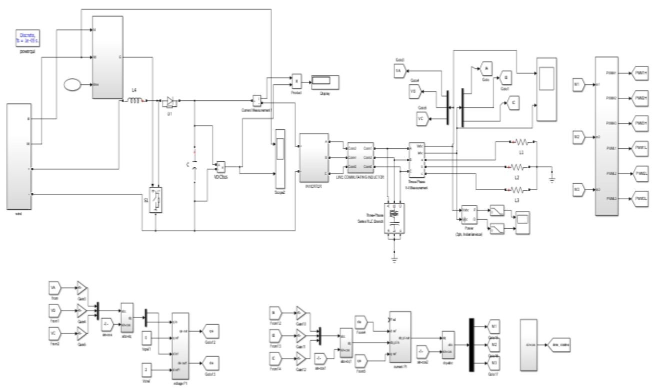

Fig 6 Complete SIMULATION model if proposed work

B. Wind power generation

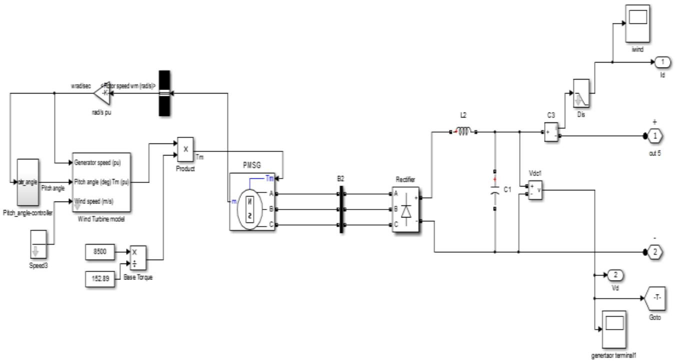

Fig 7 Wind Turbine modelling

C. Wind Voltage Waveform

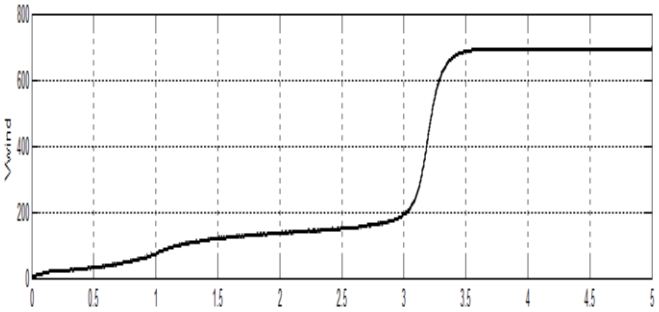

Fig 8 wind voltage waveform

D. Wind Current Waveform

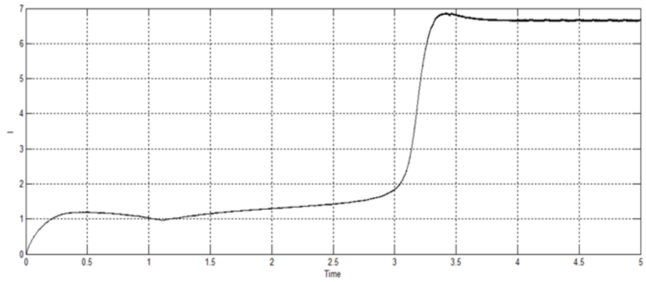

Fig 9 Wind Current Waveform

E. Wind MPPT

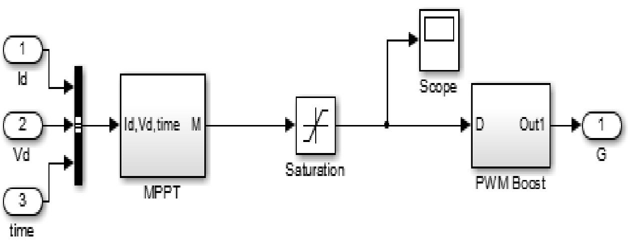

Fig 10 Wind MPPT

F. Boost Voltage waveform

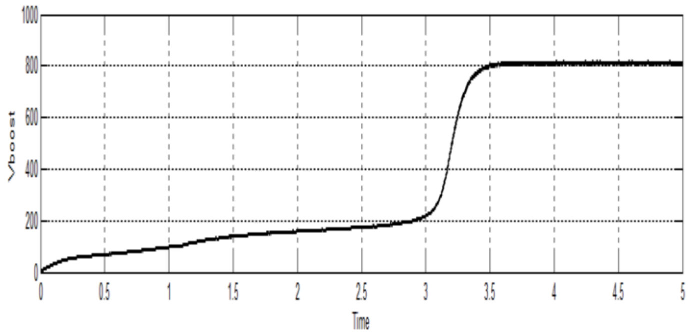

Fig 11 Boost Voltage waveform

G. Inverter Circuit

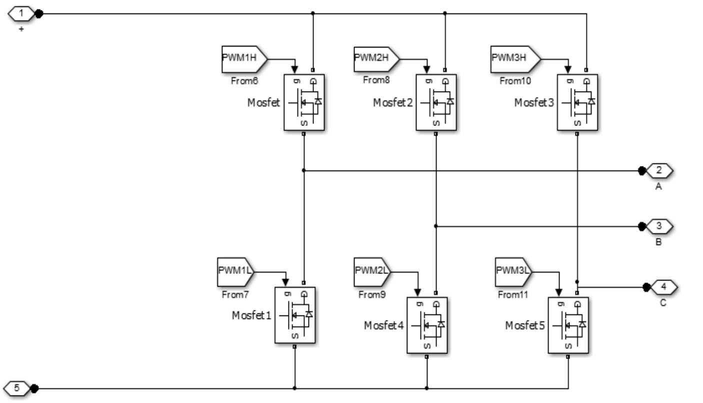

Fig 12 Inverter Circuit

H. abc to dq model

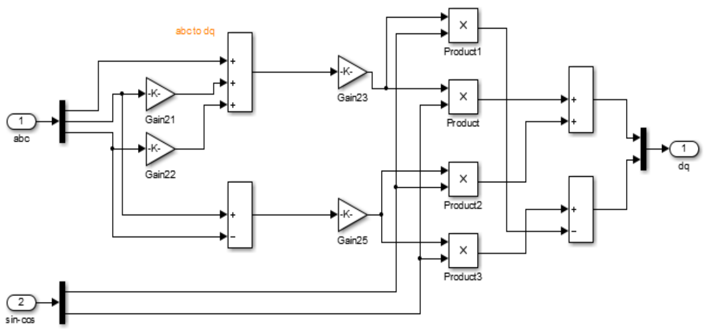

Fig 13 abc to dq model

I. dq to abc model

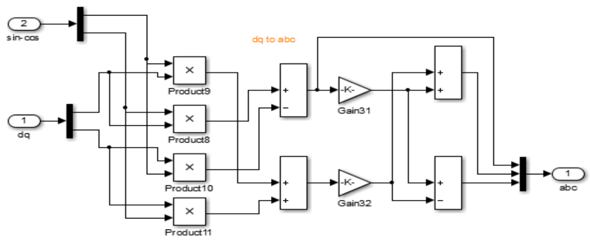

Fig 14 dq to abc model

J. Voltage Current Waveform

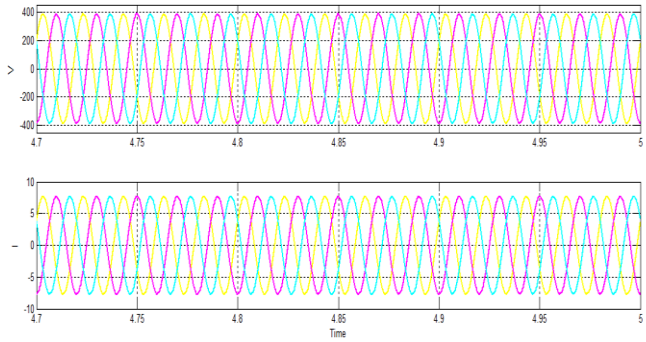

Fig 15 Voltage Current Waveform

K. Active Reactive Power

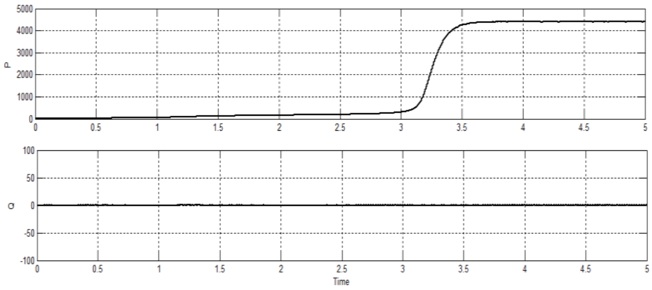

Fig 16 Active Reactive Power

L. MPPT graph

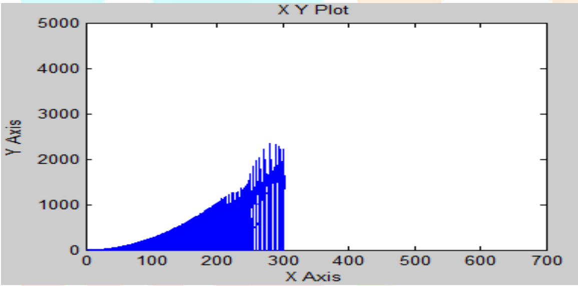

Fig 17 Graph of MPPT

CONCLUSION

In this project work, the wind energy system is implemented using MATLAB Simulink. The model consists of wind generator model based on PMSG, MPPT control model and PI converter model. The maximum power extraction from the wind energy system through the MPPT algorithm showed fast and accurate output. Renewable energy generation is fluctuating so, the MPPT control model implemented which generates the duty cycle to track the maximum and accurate power through the PI based converter system. In future, the model will be extended to the various types of MPPT algorithms as well as the various types of wind energy system components.

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