DC BUS VOLTAGE CONTROL OF PWM CONVERTERS IN PMSG IN WIND POWER SYSTEM

Krishnamoorthy.M[1]| Andal. S[2]|M.Varatharaj[3]

[1](Dept of EEE, Christ the king engineering college, Coimbatore, India, moorthykrishna788@gmail.com)
[2](Asst Prof Dept of EEE, Christ the king engineering college, Coimbatore, India, andals18@gmail.com)
[3](HOD,Dept of EEE, Christ the king engineering college, Coimbatore, India, varatharaj_ms80@rediffmail.com)

Abstract— This project proposes the control strategies of back to back PWM converters in PMSG wind power system for the grid voltage. During Fault and the maximum power point tracking condition, the dc link voltage can be controlled at the machine side converter. While the grid side converter control the grid active power for maximum power point tracking. At the grid fault condition, the dc link voltage controller, the validity of this control algorithm has been verified by the simulation of the 2MW PMSG wind turbine system, the reactive power will be controlled into the machine side converter. The process of compensating real power and reactive is known as synchronization process. The power will be transfer into the grid the pulse width modulation real power compensation.

Keywords—** DC **link voltage, pulse width modulation, controller.

1. INTRODUCTION

The dc link voltage controller is designed at machine side converter and grid side converter in PMSG using feedback linearization theory .The generator side converter control, the maximum power point tracking control and the pitch angle control. The grid side converter controller is used to keep the dc link voltage constant and yield a unity power factor looking into the wind turbine. The generator side converter controller has the ability of regulating the torque active and reactive power. The maximum power point tracking controller is used to provide the reference values for the active power at the stator terminals. The operation of the grid side converter is directly affected by grid voltage drop. And then the power transferred to the grid is decreased. The wind turbine and generator operate as it is in normal condition. Therefore in the dc link controller, excessive power transferred from the generator.

2. PWM CONVERTER IN PMSG WIND TURBINE SYSTEM

The permanent magnet synchronous generator connected wind turbine plate is rotating into the natural air. The PMSG connecting into the wind turbine, reactive and real power will be synchronized into the park transformation equal and oppose the transformation.

3. PARK TRANSFORMATION

At the grid fault condition, STATCOM is used to inject the reactive power to the grid. In conventional PMSG wind turbine system a breaking chopper employed for the system. It cannot protect the rotor side converter. Now capability of returning the power to the system. STATCOM which is installed at the common coupling has been used to inject the reactive power to the grid transfer. The PMSG wind turbine system breaking with the low cost advantage power capability at the output system. It cannot protect the rotor side converter. Both the transient state and steady state. However the STATCOM. Another different employs the energy storage system can the park transformation process is obtained into the d axis reference current component is to zero and then the q axis current is proposal to the active generator power .Power which is determined by the dc link voltage controller. the p and q axis current controller is synchronous the real and reactive power there will be compensating the power .That is the reactive power opposed into the real power thus the park transformation of machine side converter.

Existing method not only offer a ride through capability but also suppress .The out power of .the PMSG control system consisting of machine side converter and grid side converter is analyzed section .The collection of equipment is STATCOM the real and reactive power it cannot be fully compensated. But the PWM converter compensating the reactive and real power compensate and synchronous the real and reactive power .and the park transformation reactive power compensate the PMSG the variable speed consists and the generate the voltage. The error voltage cannot pro

tect into the electronic converter.

4. EXSISTING METHOD

As the scale of wind farms becomes larger and larger, the condition of the grid-connected wind turbines is more important. Recently, some countries have issued the dedicated grid codes for connecting the wind turbine system to the grid , . Also, the smart-grid and the micro-grid have been researched for the efficiency of the power management. However, the grid voltage in these systems is more fluctuated than that of the conventional grid. Therefore, an advanced control of the wind power generation system is required for the grid abnormal conditions. Several solutions have been proposed for the grid faults in the variable-speed wind turbine systems. For the low voltage ride-through (LVRT) purpose, a crowbar system consisting an external resistor is connected in the rotor-side of the doubly-fed induction generator (DFIG) to absorb the active power during the grid fault . The wind

5.PROPOSED MPPT CONTROL:

The dynamic response of the optimal torque control (conventional control method) and the proposed torque control methods ,respectively ,when the speed changes from easy investigation ,the grid is assumed to be normal .Also ,the damping coefficient is neglected in the simulation .Compared with the optimal torque control method ,proposed method is gives the faster response during the step wise changes of the speed .

6. PROPOSED METHOD:

In the PMSG wind turbine system the generator is connect through the full scale back to back PWM converters .the STATCOM using into the machine side converter fully does not protect. Into the reactive and real power but its using into the PWM converter. The real power and reactive power synchronous .Park transformation oppose into the reactive and real power .when the wind speed varies the dynamic response in the optimal torque control .The controller is effective only in the transient state and its effect. Vanishes in the steady state where the proposed controller has the same characteristics .the basic principle is that the generator side converter should try adjust the generator output power to balance the load power need such that the dc link voltage can be controlled into the reactive power. The electrical power varies faster than the mechanical one due to the turbine and generator inertia .if an inertia is large any change of the turbine speed will cause a large variation of the generator power .then the kinetic energy is absorbed or released so slowly that the performance of the MPPT becomes slow thus, a slowly.

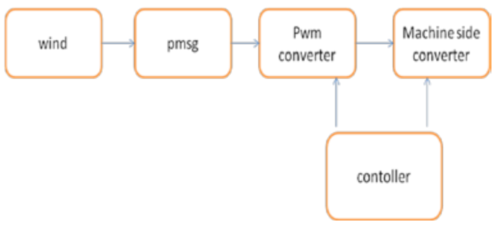


Fig.1.block diagram of proposed method

The wind system connected into the PMSG .the PWM converter using into the detection of reactive power and given into the machine side converter .That the performance of the MPPT becomes slow. Thus a propositional controller employed to reduce the effects of the inertia moment and the damping coefficient. With the proposed torque control method, whose block is shown in the Fig 2.

7. **PMSG CONTROL SYSTEMCONTROL OF MACHINE-SIDE CONVERTER FOR CONSTANT DC VOLTAGE**

Conventional DC-Link Voltage Control The control loop of the pulse-width modulation (PWM) converter usually consists of the outer DC link voltage controller and inner AC input current controller. The IP DC-link voltage controller is preferred since it gives less overshoot than the PI-type.

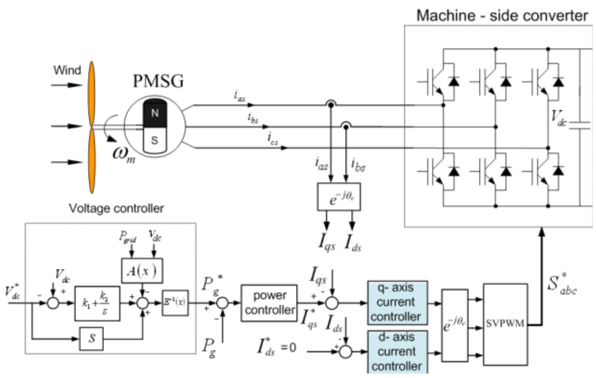
The output power can be calculated as

$Pg=1.5(VqsIqs+VdsIds)$ (1)

$C/2\ dv^2dc/dt = Pin-Pout$ (2)

For the PMSG, to achieve maximum torque control sensitivity, and improve dynamic machine response, d□axis current (Ids) and is controlled to zero. Thus and are expressed as where C is the DC-link capacitance, Pin is the input power of the PWM inverter, which is obtained from Eq. (1).For the PMSG, to achieve maximum torque control sensitivity, and improve dynamic machine response, d□axis current (Ids) .is controlled to zero Thus, E and Eq. (2) are expressed as where C is the DC-link capacitance, Pin is the input power of the PWM inverter, which is obtained from Eq. (1). For the PMSG, to achieve maximum torque control sensitivity, and improve dynamic machine response, d□axis current (Ids) in Eq. (1) is

8. CIRCUIT DIAGRAM



Form the Fig.2.circuit diagram

Method, the generator power reference is produced through the DC-link voltage controller instead of the maximum power point tracking controller. For vector control of a PMSG, the cascaded control structure of the machine side the block diagram of the proposed nonlinear DC-link voltage control is partially shown in Fig. 2. Unlikely the converter is composed of the outer generator power control loop and the inner current control loop. In order to obtain maximum torque at a minimum current ,the d□axis reference current component is set to zero and then the q□axis current is proportional to the active generator power, which is determined by the DC link voltage controller. Conventional

Rated power	2MW
Blade radius	45m
Air density	1.255kg m^-3
Air density	1.255kg m^-3
Max power conv.coefficient	0.411
Cut in speed	3m/s

9. SIMULATION RESULT:

To verify the effectiveness of the proposed, the simulation has been carried out using the PSIM software for a 2-MW PMSG wind turbine the parameters of the wind turbine and generator are used in tab 1 and tab2 respectively. The DC link voltage is controlled at 1300v,The DC link capacitance is 0.1F The switching

TABLE I

Parameters of wind turbine:

frequency is 2KHZ and the grid voltage is 690/60HZ. method ,the generator power reference is produced through the DC-link voltage controller instead of the maximum power point tracking controller. For vector control of a PMSG, the cascaded control structure of the machine side the block diagram of the proposed nonlinear DC-link voltage control is partially shown in Fig. 3. Unlikely the converter is composed of the outer generator power control loop and the inner current control loop. In order to obtain maximum torque at a minimum current ,the d□axis reference current component is set to zero and then the q□axis current is proportional to the active generator power, which is determined by the DC link voltage controller.

Conventional control loop and the inner current control loop. In order to obtain maximum torque at a minimum current ,the d□axis reference current component is set to zero and then the q□axis current is proportional to the active generator power, which is determined by the DC link voltage controller. The given simulation Out-put result gives us Rotor speed of wind turbine, wind turbine torque, turbine pitch, Torque (mechanical, overshoot than the PI-typeelectrical, torsional) as show fig.4. DC link voltage output wave from as show on fig.5.

TABLE II

Parameters of PMSG Wind Generator

Rted power	2MW
Grid voltage	690V
`Stator voltage/frequency	690V/60HZ
Stator resistance	0.008556H
d-axis inductance	0.00359H
Q-axis inductance	0.00359

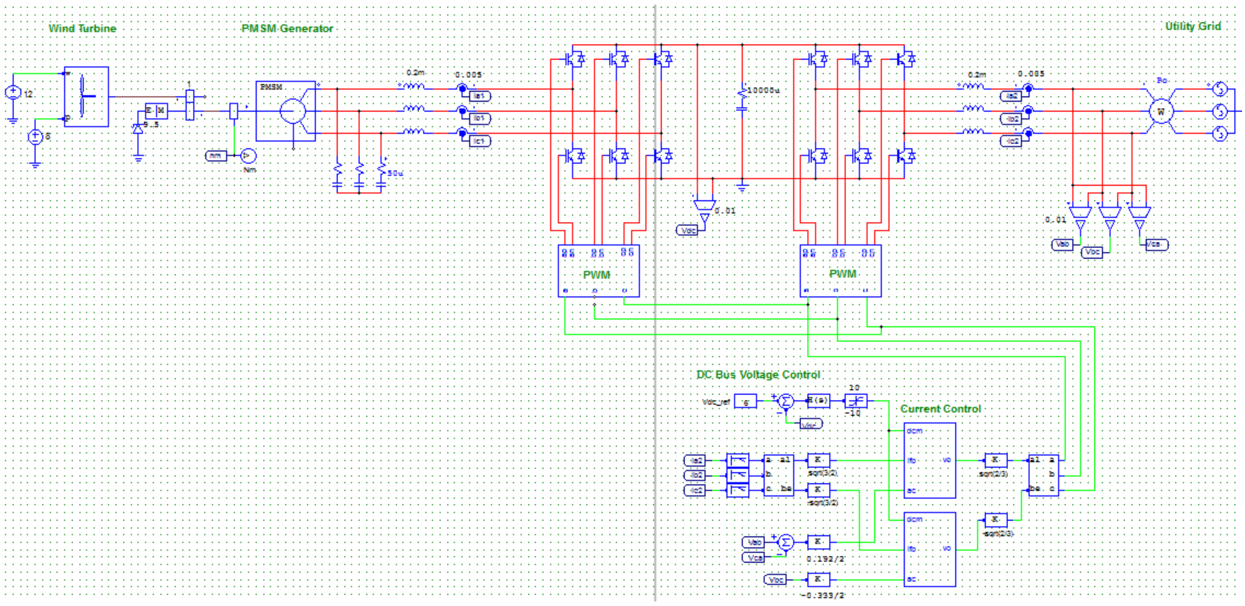


Fig.3.Simulation of *Pwm Converters in PMSG in Wind Power System*

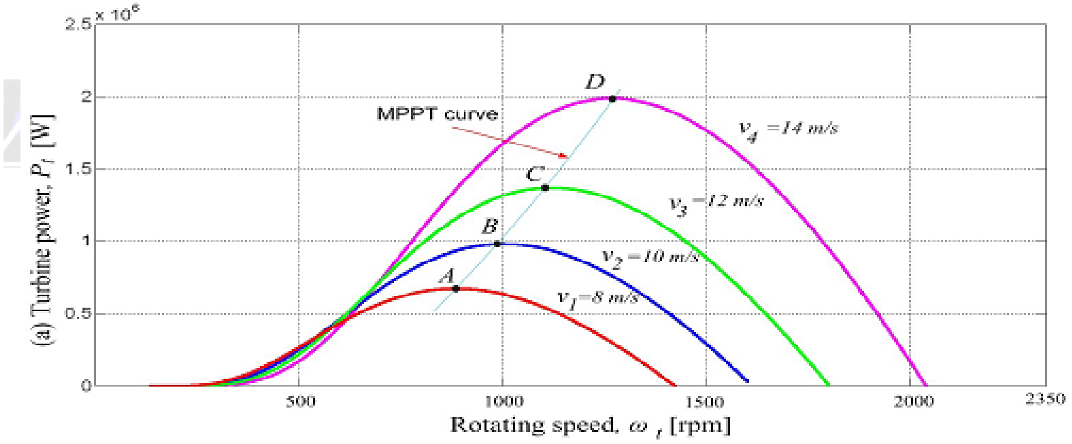


Fig.4 (a) turbine power,Pr[W]

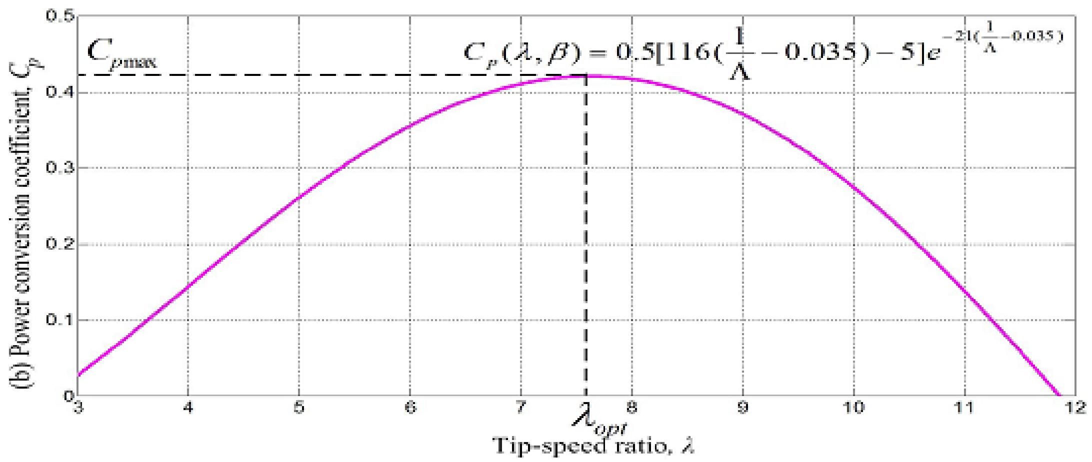


Fig.4(b) power conversion coefficient

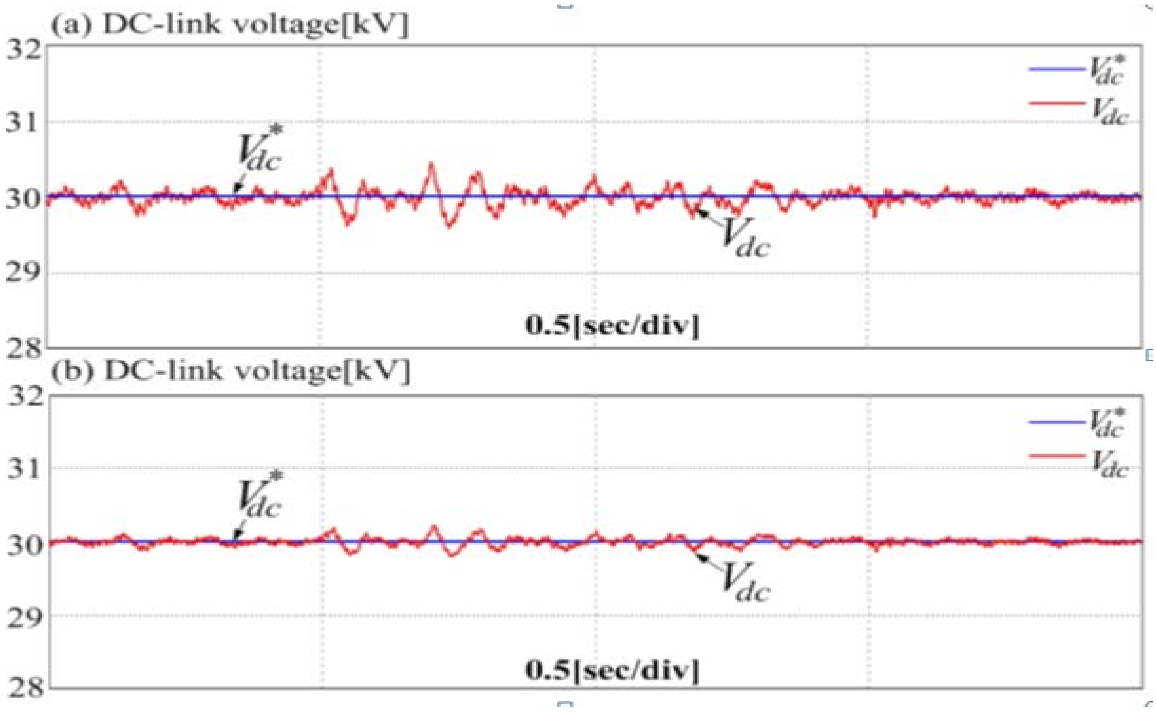


Fig.5. (a) and (b) Dc Link Bus Voltage Waveforms

10 . CONCLUSION

This paper proposes the control strategies of the DC bus link voltage control of PWM converters in PMSG wind power system, for the grid voltage faults and for the MPPT. At the grid fault, a method is based on the DC-link voltage control at the machine-side converter. Where a proportional controller is added to the torque controller to improve the dynamic performance of the MPPT control is developed to control the grid power at the grid-side converter. The validity of the control algorithm has been verified by simulation results for PMSG wind power system

REFERENCE

[1] Tan Luong VAN, Thanh Dung NGUYEN, Thanh Trang TRAN, Huy Dung NGUYEN Advanced Converters in PMSG Control Strategy of Back-To-Back PWM Wind Power System IEEE Transactions on energy conversion 2015, vol.13.

[2] Chinchilla, M., S. Arnaltes and J. C. Burgos. Control Of Permanent-Magnet Generators Applied To Variable-Speed Wind Energy Systems Connected To The Grid. IEEE Transactions on Energy Conversion. 2006, Vol. 21.

[3] Polinder, H., F. F. A Van Der Pijl and P. Tavner. Comparison of Direct-Drive and Geared Generator Concepts for Wind Turbines. IEEE Transactions on Energy Conversion. 2006, Vol. 21.

[4] Iov, F., A. D. Hansen, P. Sorensen and N. A. Cutululis. Mapping Of Grid Faults and Grid Codes. Technical Report Riso-R-1617(En). Roskilde, Riso National Laboratory, Technical University of Denmark, 2007.

[5] Saniter, C. And J. Janning. Test Bench for Grid Code Simulations for Multi-Mw Wind Turbines, Design and Control. IEEE Transactions on Power Electronics. 2008, Vol. 23.

[6] Jeon, J.-H., S.-K. Kim, C.-H. Cho, J.-B. Ahn and E.-S. Kim. Development of Simulator System for Micro-Grids with Renewable Energy Sources. Journal of Electrical Engineering And Technology. 2006, Vol. 1.