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Original Research Article

IMPLEMENTATION OF 11 LEVEL INVERTOR WITH PMSG FOR WIND MILL

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Abstract: To cope up with challenges of power demand and supply gap it's essential to deal with the advancement in the field of renewable energy with highest potential. In country like India where the power system restructuring and advancement in energy sector is taking rise in recent years, so it's great opportunity to have a system with the isolated operation due to variations in the geographical conditions. In this work a wind mill technology with the isolated operation is presented of 8.5kW, for residential purpose. The direct drive PMSG (permanent magnet synchronous generator) type of generator is used, which is suitable for the variable kind of wind speed. A performance of the PMSG is studied under the different wind speed conditions with the adequate control mechanism. As due to change in the speed of wind the voltage and current changes, these variations are avoided by means of adjusting the control signal PWM provided to the buck boost converter. With the lead acid battery a constant DC voltage level is maintained at the input terminals of inverter.
11 level inverter topology is used to avoid the harmonics contents in the output side with passive LC filter. For optimal power from the wind turbine and to ensure maximum efficiency MPPT block is used which improves the reliability of the system. The simulation study is carried out based on MATLAB/Simulink to validate the proposed system control algorithms.

Keyword: Turbine, variable speed wind turbine, wind energy conversion systems, permanent magnet synchronous generators

Introduction: Current rating of such gadgets is restricted up to 16 A for each stage. Some vitality sources can be associated specifically to the circulation organize, however on account of DC power sources or variable speed wind turbine (VSWT) frameworks it is important to utilize a power converter that interfaces the source and the network. Wind turbines catch wind vitality and change over it to rotational mechanical vitality. Variable speed operation of the wind turbine permits extraction of higher

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vitality from twist than consistent speed frameworks. The generator changes over mechanical vitality into power. Diverse sorts of generators can be utilized as a part of wind vitality transformation frameworks (WECS) The primary preferred standpoint of PMSG is the likelihood of different plans that offers moderate speed operation and the likelihood of gearless WECS development. Another favorable position is sans support operation since there are no brushes. The fundamental disadvantage of PMSG is the reliance of its yield voltage on the revolution speed.

Different Topologies Interfacing Converter for Wind Turbine: Essentially they can be separated into two gatherings: topologies without galvanic disconnection (Fig. 1a) and those with confinement. Line recurrence (LF) transformers (Fig. 1b) were broadly utilized for galvanic segregation in decades ago. Principle downsides of LF transformer are high weight and high cost. Hence topologies with HF seclusion (Fig. 1c) have wound up noticeably prevalent particularly for photovoltaic applications and wind control applications. [2]

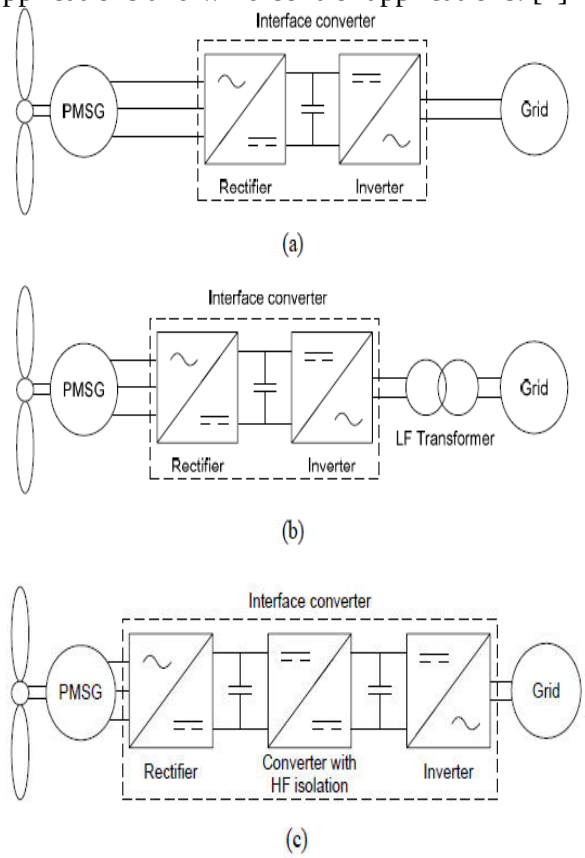

Fig 1: Block diagram of interfacing converters

11 Level Inverter: The concept is carried out for the analysis and implementation techniques for power demand and supply gap it's essential to deal with the advancement in the field of renewable energy with highest potential. In country like India where the power system restructuring and advancement in energy sector is taking rise in recent years, so it's great opportunity to have a system with the isolated operation due to variations in the geographical conditions. In this work a wind mill technology with the isolated operation is presented of 8.5kW, for residential purpose. The direct drive PMSG (permanent magnet synchronous generator) type of generator is used, which is suitable for the variable kind of wind speed. A performance of the PMSG is studied under the different wind speed conditions with the adequate control mechanism. As due to change in the speed of wind the voltage and current changes, these variations are avoided by means of adjusting the control signal PWM provided to the buck boost converter. With the lead acid battery a constant DC voltage level is maintained at the input terminals of inverter. 11 level inverter topology is used to avoid the harmonics contents in the output side with passive LC filter. For optimal power from the wind turbine and to ensure maximum efficiency MPPT block is used which improves the reliability of the system. The simulation study is carried out based on MATLAB/Simulink to validate the proposed system control algorithms.

Results and Discussion: Some important key points and results (add them according to your report sequence) Following results are obtain after running simulation on the wind speed of base speed 12m/s.

Variations are kept as follows12m/s, 7m/s, 15m/s for the interval of 5 seconds for simulation purpose. In actual case it may depends on the environmental conditions. We can change it by means of changing the parameter block of variable wind speed block Ws.

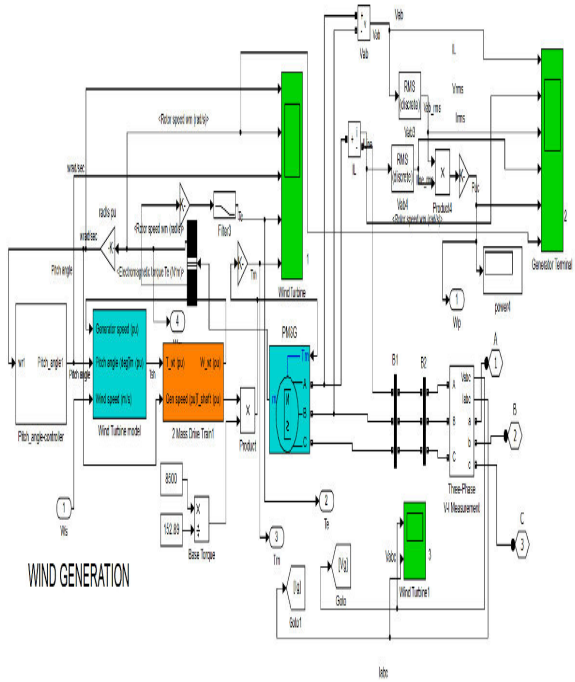

Fig 2: Wind mill Block with MPPT and turbine generator set

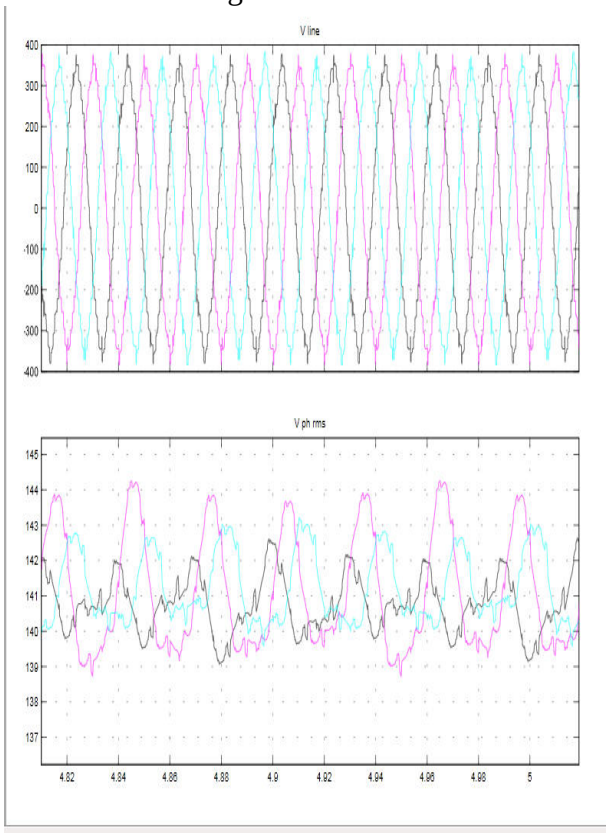

Fig 3: Multi level Inverter Output voltage

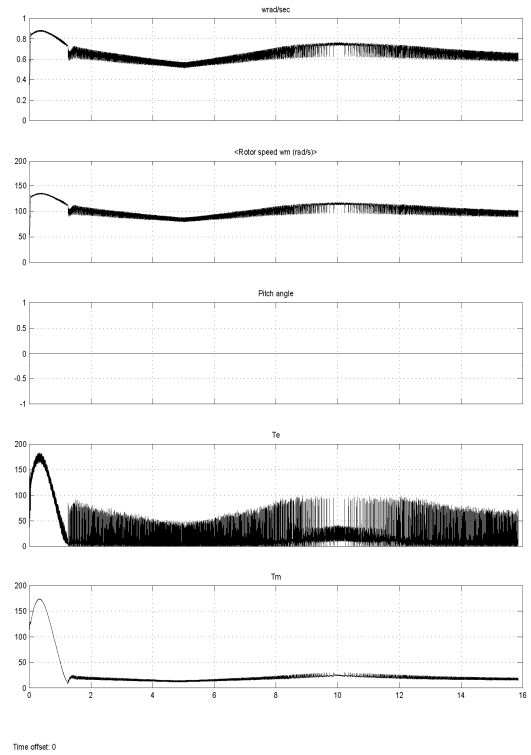

Fig 4: Mechanical, Electrical Torque and rotor speed with pitch angle

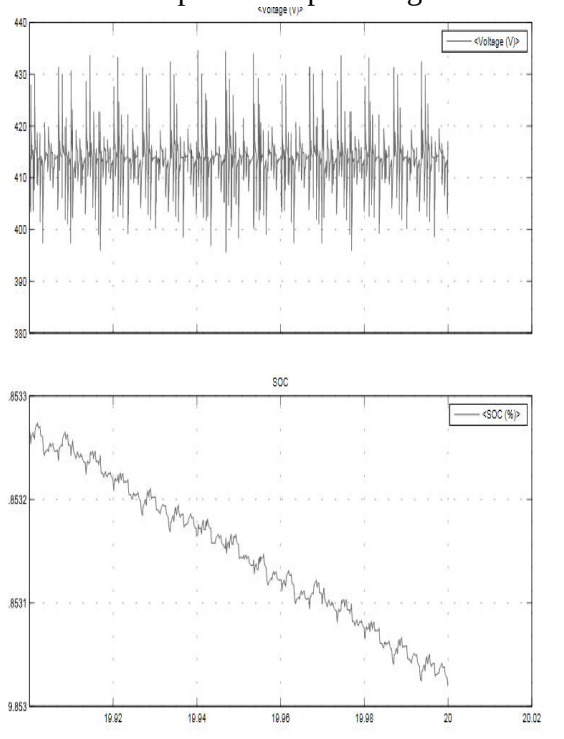

Fig 5: Battery Voltage and SOC

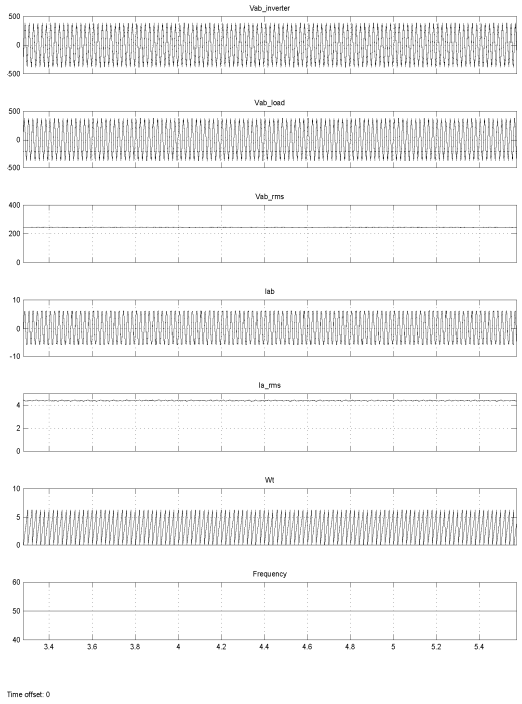

Fig 6: Load voltage and current RMS values

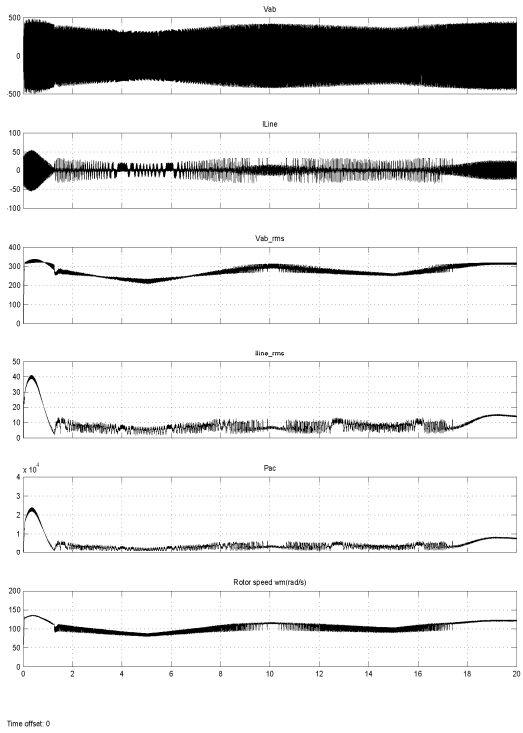

Fig 7: Generator terminal Parameter

Conclusion: As the wind speed varies the voltage and current also varies. In standalone operation of PMSG based wind mill generation these variations are compensated by means of using buck boost converter with the lead acid battery set. The pitch angle controller is used to control the blade angle at θ=0. The MPPT is used to track the maximum power. Also a major role played by 11 level inverter is to reduce the harmonic contents from voltage and current, this is the advantage of multilevel inverter. Here PI controller is used to control the inverter output rms voltage and LC filter is used to remove the harmonics available in the system. Further work can be expanded for the non linear load in the standalone system with the shunt and series active filter technology for the elimination of bad power quality from the power system.

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