ENHANCEMENT OF POWER QUALITY OF GRID-CONNECTED WIND ENERGY SYSTEM USING STATCOM

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***Abstract*: The Demand for energy has been increasing day by day. This method involves enhancement in energy potency, a far bigger offer of energy from renewable sources and rising power quality of Generated energy from those sources. If an alternative energy source is connected to electrical grid it affects the facility quality because of non-linear nature of the wind energy. When wind power is given to the electric grid it affects the power quality. The effects of the power quality measurement are the active power, reactive power, variation of voltage, flicker, harmonics. In order to reduce these, Flexible alternate current transmission system (FACTS) devices are used. The most efficient one is STATCOM. FACTS devices provide smooth and proper integration of wind energy system to the grid.**

1. INTRODUCTION

Wind is the natural moment of air across the land or sea. Wind is caused by uneven heating and cooling of the earth surface and by the earth location. Land and water areas absorbs the heat and release different amount of heat received from the sun. when the warm air rises and cooler air rushes in the place and causes local wind. The rotation of the earth changes the direction of the flow of air. Nowadays the Wind power is most popular and growing source of energy. wind energy source is renewable energy-based systems with zero emissions and pollutions. The countries like India and other countries where energy production is based on coal or oil will become self-sufficient by using alternatives such as wind power. Electricity produced from the wind produces no Co_2 emissions and therefore does not contribute to the greenhouse effect. In the remote areas or the areas which having weak grid, wind energy can be used for charging batteries and combined with the diesel engine to save fuel whenever wind is available.

1.1. WIND ENERGY GENERATING SYSTEM:

The shunt connected STATCOM with the battery storage connected with an interface of the induction generator and the non-linear load at the PCC in a grid system. The STATCOM compensator output is varied according to the control strategy,so as to maintain the power quality norms in the grid system. The current control strategy is included in the control scheme that non-linear load in the grid system. The STATCOM control scheme is based on injecting the current into the grid using bang-bang controller. The controller uses a hysteresis current controlled techanique. Using of this method, controller maintains the control system variable between boundries of hysteresis area and provides the correct switching signals for the STATCOM operation.

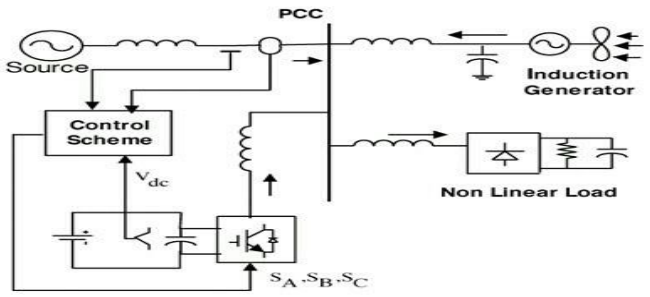

Fig 1: Grid connected system for power quality.

1.2. POWER QUALITY ISSUES:

The voltage stability, frequency stability, and the absence of the various forms of electrical noise (Flickers,Harmonic Distortion) on a electrical grid witch referred by a power quality. More broadly speaking, Power companies prefer an alternating current with a sinusoidal shape.

1.3. BANG-BANG CURRENT CONTROLLER:

Bang-Bang current controller is enhancement or implementation in the current control scheme. The generated reference current and the actual current are detected from the current sensors and are subtracted to get the current error for a hysteresis based on bang-bang controller. Thus, the ON/OFF switching signals for the IGBT of STATCOM are derived from the hysteresis controller.

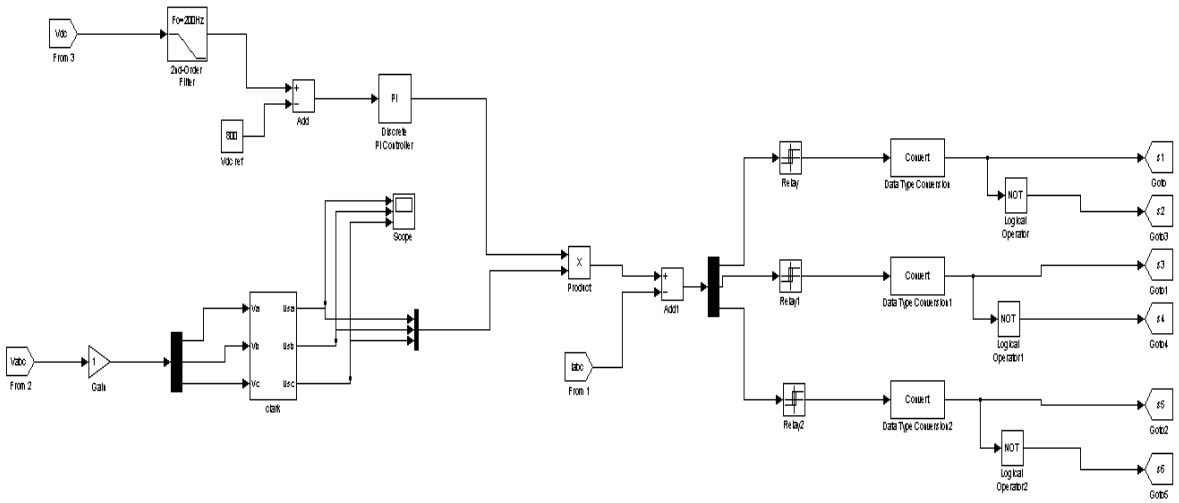

Fig 2: SIMULINK model of the proposed Bang-Bang controller scheme.

2. METHODOLOGY

2.1. STATCOM-PERFORMANCE UNDER LOAD VARIATIONS:

STATCOM could be a controlled reactive-power supply. It provides the specified reactive-power generation and absorption entirely by means that of electronic process of the voltage and current waveforms in a VSC. A STATCOM principle diagram is shown in Figure 4

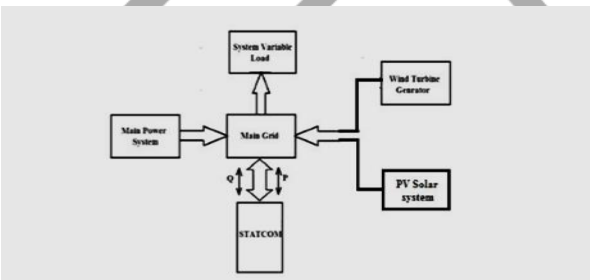

Fig 3: proposed approach block diagram.

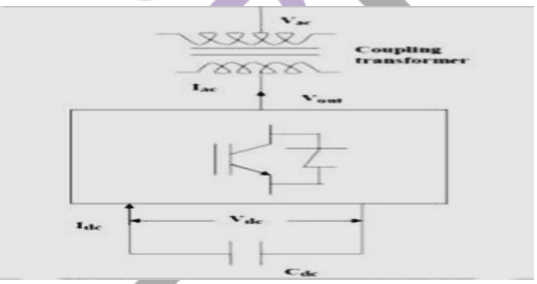

Fig 4: A Basic model of STATCOM.

The VSC is connected to a utility bus through shunt electrical device. Vacation is that the bus voltage. Iac is STATCOM injected current. Vout is that the VSC output voltage. DC voltage and DC current square measures the DC electrical device aspects that is voltage and current. The IGBT with back to back diodes indicates the three arm IGBT bridge. Top three IGBTs area unit referred to as positive cluster and bottom three IGBTs area unit referred to as negative cluster IGBTs. once IGBTs conduct and convertor operation takes place, the electrical converter operation takes place. once diodes conduct. Figure three shows the conception of STATCOM power exchange.

3. SIMULINK MODEL

The proposed operational and control scheme simulated using Simulink into power system block set is shown below.

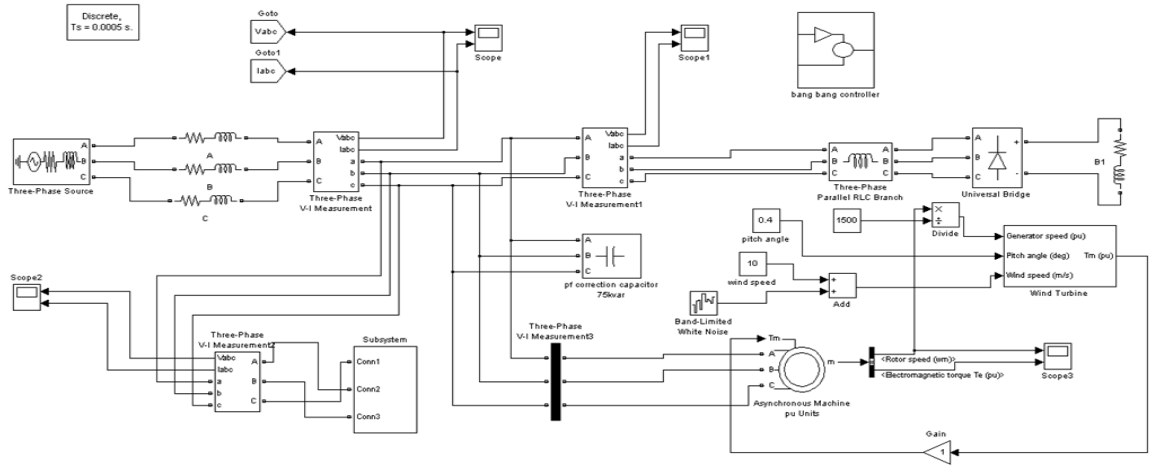

Figure 5: SIMULINK model of the proposed operational scheme.

4. RESULT

Based on analysis of large-scale wind farm operation for mentioning combination various technical issues related with interfacing of large-scale wind farms to grid. The operation of the control system developed for the STATCOM based control scheme as a controller we used Bang-Bang Controller in MATLAB/SIMULINK for maintaining the power quality is simulated. It has the capability to cancel the flicker parts of the load current. It maintains the source voltage and current in-phase and support the reactive power demand for the wind generator and load at Point of Common Coupling (PCC)in the grid system.

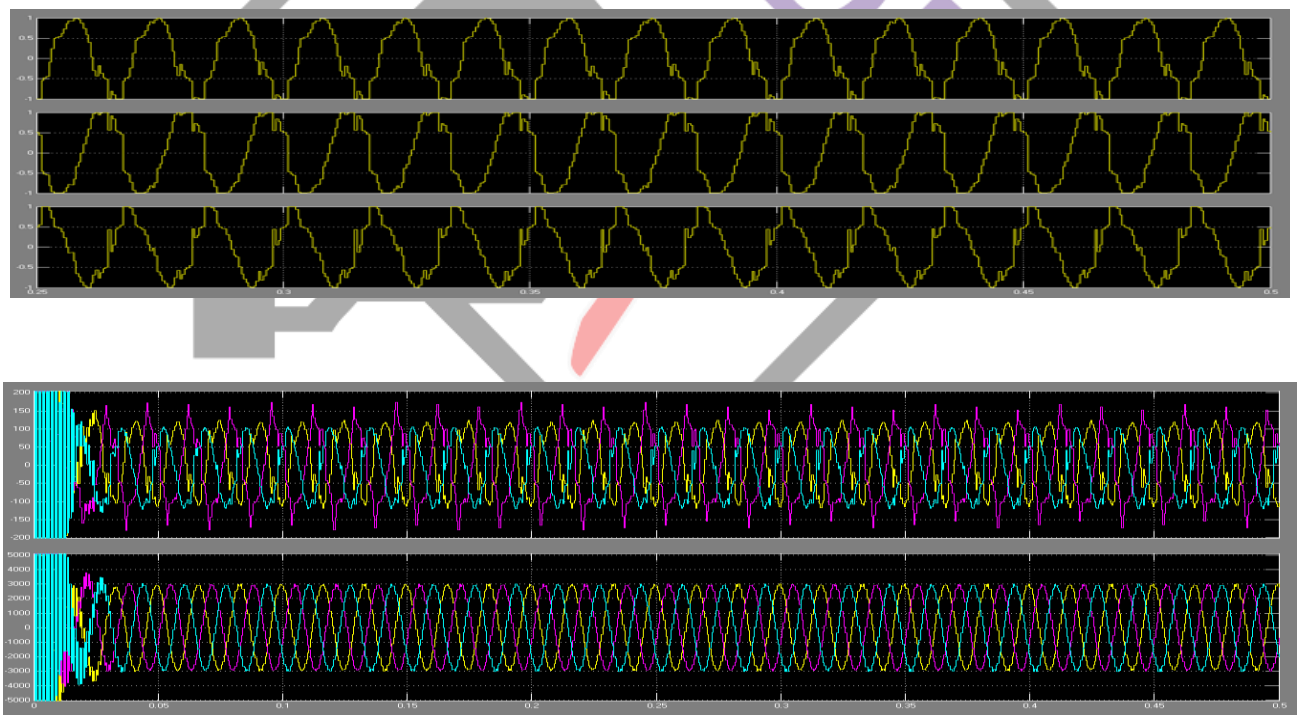

Fig 6: Bang-Bang controller of STATCOM.

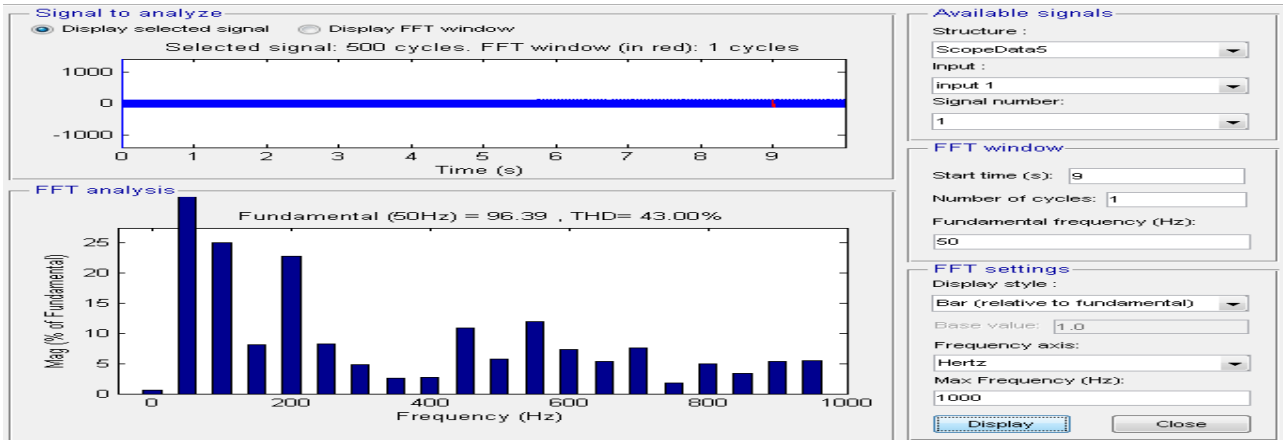

Fig 5: Three phase source Current & Voltage output with STATCOM & its FFT analysis.

5. CONCLUSION

This paper presents the STATCOM based control scheme for power quality improvement in grid connected wind generating system with nonlinear loads. The operation of the STATCOM is simulated using two controllers Hysteresis current controller and PI controller. In this proposed scheme to eliminate the harmonic content of the load current the STATCOM –BESS control system is used. So that power quality is maintained at the point of common coupling (PCC), and Hysteresis current control scheme in the STATCOM is used for the fast-dynamic response it also maintains voltage and current in phase. STATCOM is well suited for improvement of the power quality of a grid. The control system for STATCOM is simulated using MATLAB/SIMULINK. This power quality also improves by STATCOM by absorbing and generating reactive power using voltage source convertor (VSC) using DC link that is Battery system.

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