Power Quality DVR-ESS Embedded Wind-Energy Conversion System

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Abstract- *The system approach is to develop analytical aspects and to illustrate these by an example of a real distribution system. Voltage sag can be eliminated by continuously injecting very small voltage profile to the system. The DVR, which is placed in series with a sensitive load, must be able to react speedily to voltage sag if end users of sensitive equipment are to experience no voltage sags. In modern power system, advent and installation of extensive non-linear electronic devices as well as the sudden disturbing events causes various power quality (PQ) problems. The proposed method versatile nonlinear modulation strategy (VNMS) algorithm used quality of power is recognized due to the various power line disturbances like voltage sag, swell, harmonics, etc. Recent failure statistics have confirmed that voltage sags represent the most common type of disturbance in the power grid. The wind power generated from pulse with modulation in to injected transformer. The wind gives to DC-DC link power increasing to the injection transformer step up load.*

Keywords- Wind power, Step down Transformer, Rectifier, Boost converter, DC link, Storage unit

I. INTRODUCTION

1.1 **PROLOGUE ABOUT THE PROJECT**

Control of a wind turbine is very complex since the energy input that comes from the wind is highly fluctuating. These fluctuations will also introduce variations in the produced electric power which causes a negative power quality impact. In order to keep the extracted power within rated limits, the raw/pitch rotor has to be controlled. Extreme conditions maybe experienced with the machine operating, parked or idling with or without various types of fault or grid loss, or during a particular operation such as a shut-down event. The FPGA based controller receives external sensor inputs according to the operating conditions the wind conditions and the operator's intentions. The controller monitors operating conditions and functional sequences and makes quick, pipelined decisions. Some of control loops may require very fast responses in order to prevent the turbine wandering far from its correct operating curve. Such controllers may need to be designed very carefully if good performance is to be achieved without detrimental effects on other aspects of the turbine's operation. Others, such as yaw control, are typically rather slow acting, and careful design is then much less critical.

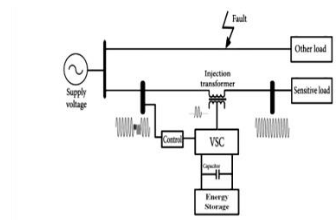

Fig. 1.1 –Basic DVR Bus Topology

1.2 IMPORTANCE OF THE PROJECT:

The continuous increase in energy demand and environment concerns, renewable energy development has become a global trend. Among various modern renewable energy resources, wind power exhibits the highest proportion and is anticipated to keep steady growth in make these wind power stable and profitable, developing efficient control strategies of wind energy conversion systems (WECSs) becomes crucial in wind power utilization. Generally, the control objective of the WECS depends on its operating regions. To be specific, a characteristic curve of a variable-speed variable-pitch.

An efficient control strategy of a wind energy conversion system (WECS) plays a crucial role in wind power utilization. In this paper, a novel multivariable control strategy for a variable speed variable-pitch WECS is proposed. It is designed for the complete operating regions of a wind turbine, including both of the partial load region and the full load region, with the objectives of maximizing energy capture, smoothing power output, Alleviating drive train transient loads, and reducing pitch actuator activities

1.3 OBJECTIVE

The grid connected wind energy generation system for power quality improvement by using STATCOM has the following objectives.

To maintains power factor as unity at the source end.
To meet the reactive power to wind generator and non-linear load.

To provides hysteresis current controller for STATCOM to achieve fast dynamic response.

II. CONVENTIONAL SYSTEM

2.1 INTRODUCTION

Power quality problems begins with nonstandard voltage, current and frequency which causes failure or disoperation of end user equipment's. Among that voltage sag is major problem. To minimize this problem custom power devises are used such as and dynamic voltage restorer (DVR). This project gives investigation on DVR which having low cost, small in size and fast dynamic response to the disturbance. Modeling and analysis of dynamic voltage with sinusoidal pulse width modulation (SSVPWM) based controller using MATLAB/ Simulink is presented.

2.2 BLOCK DIAGRAM

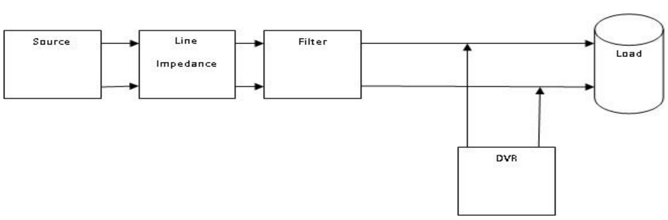

Fig. 2.1 –Conventional System Block Diagram

2.3 BLOCK DIAGRAM EXPLANATION

The major objective of the DVR is to increase the power utilization capacity of distribution feeders, reduce the losses and improve power quality at the load. The main assumption is to neglect the variations in the source voltages.The Injection / Booster transformer is a specially designed transformer that attempts to limit the coupling of noise and transient energy from the primary side to the secondary side.The main task of harmonic filter is to keep the harmonic voltage content generated by the VSC to the permissible level.A VSC is a power electronic system consists of a storage device and switching devices, which can generate a sinusoidal voltage at any required frequency, magnitude, and phase angle.

2.4 DRAWBACKS

- High THD present in output.
- Switching losses is high.
- Slightly low optimization in output.

II. PROPOSED SYSTEM

3. 1. INTRODUCTION

The proposed approach is to develop analytical aspects and to illustrate these by an of a real distribution system. Voltage sag can be eliminated by continuously injecting very small voltage profile to the system. The DVR, which is placed in series with a sensitive load, must be able to react speedily to voltage sag if end users of sensitive equipment are to experience no voltage sags. In modern power system, advent and installation of extensive non-linear electronic devices as well as the sudden disturbing events causes various power quality (PQ) problems. The wind power generated from pulse with modulation in to injected transformer. The wind gives to DC-DC link power increasing to the injection transformer step up load. The algorithm The proposed method versatile nonlinear modulation strategy (VNMS) algorithm used quality of power is recognized due to the various power line disturbances like voltage sag, swell, harmonics, etc. Recent failure statistics have confirmed that voltage sags represent the most common type of disturbance in the power grid.

The AC Current is collected through wind and collect it by Step down tansformer, we have to convert the AC Current into DC Current by using rectifier and Boost converter or Filter Circuit, A PWM inverter - 4047 is also used to carry the Converted DC Current from the rectifier, A DC link is used to carryover the current which is stored in a Storage unit called battery. With the help of Storage unit, We can get the output result of Lamping light. If we can not get the AC Current, we also run the output with the help of storage unit.

3. 2BLOCK DIAGRAM

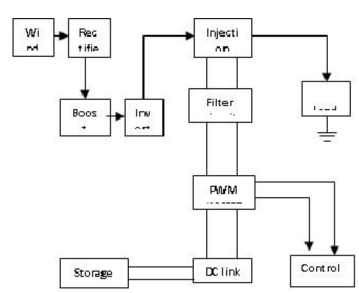

Fig. 3.1 –Proposed System Block Diagram

3.3 BLOCK DIAGRAM EXPLANATION

A boost converter (step-up converter) is a DC-to-DC power converter that steps up voltage from its input supply to its output load. Here cascaded dc-dc converter is used for improving high efficiency of the circuit.

A power inverter, or inverter, is an electronic device or circuitry that changes direct current (DC) to alternating current (AC).Electronic filters are circuits which perform signal processing functions, specifically to remove unwanted frequency components from the signal.Three single phase transformers are connected in series with the distribution feeder to couple the VSI (at the lower voltage level) to the higher distribution voltage level. The three single phase transformers can be connected with star/open star winding or delta/open star winding. The latter does not permit the injection of the zero sequence voltage.A VSC is power electronic system consists of a storage device and switching devices. It generates a sinusoidal voltage at any required frequency, magnitude, and phase angle. The function of an inverter system in DVR is used to convert the DC voltage supplied by the energy storage device into an AC voltage and to temporarily replace the supply voltage or to generate part of supply voltage.Pulse Width Modulation or PWM technology is used in Inverters to give a steady output voltage of 230 or 110 V AC irrespective of the load. The Inverters based on the PWM technology are more superior to the conventional inverters.Wind energy is a form of solar energy. Wind energy (or wind power) describes the process by which wind is used to generate electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. A generator can convert mechanical power into electricity.

3. 4 ADVANTAGES

- Improve The Harmonics Detection
- Capable Of Improving The Stability Output Voltage From Source To Feeder
- Harmonics Current And Un-balanced Voltage Is Can Be Alleviated With The Compensation Of DVR.

3. 5 APPLICATIONS

- Industrial Usage
- Renewable Energy Conversion
- UPS
- Electric Vehicles

IV. SIMULATION RESULTS

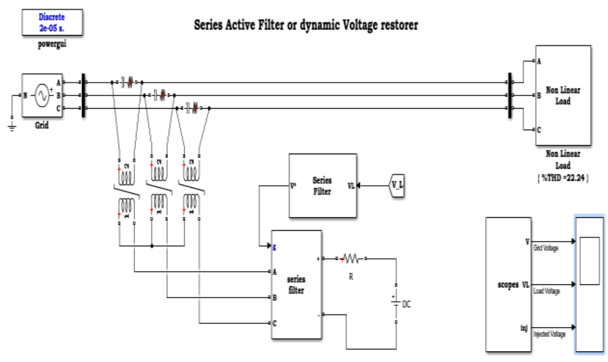

Fig. 4.1 –Simulation Circuit Diagram

Here the simulation diagram represents the regulation of the source power to grid.Both the variation of the power will be varied by series filter which will act as a reactive power of the system.At the initial time the harmonics present in the non-linear load is high. After the conversion of series filter total harmonics which is present is low.The variation of the grid voltage, load voltage.injected voltage is view on the scope of the system.

4. 1 GRID VOLTAGE

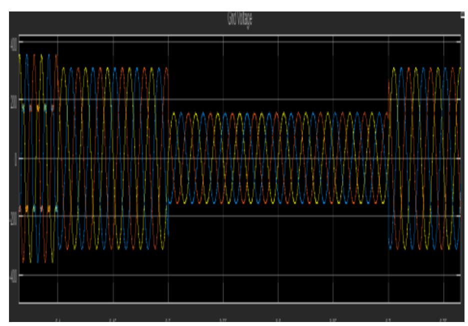

Fig. 4.2–Grid Voltage Output

The grid voltage will represent the source of the system which will generate in the power generation area.

The y-axis indicating the amplitude of the power V=350
X-axis represent the time period in microsecond

The changes in the power source will varying the sinusoidal waveform.

4. 2LOAD VOLTAGE

- The output power wills vary depending upon non-linear loads.

- The y-axis indicating the amplitude of the power V=350.
- X-axis represent the time period in microsecond.
- The changes in the power source will varying the sinusoidal waveform.

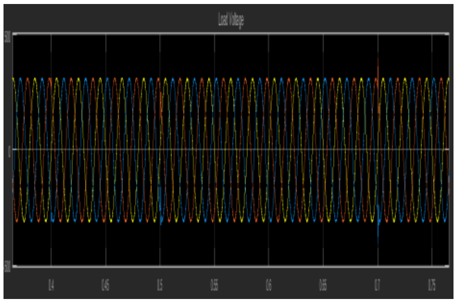

Fig. 4.3–Load Voltage Output

4. 3 INJECTED VOLTAGE

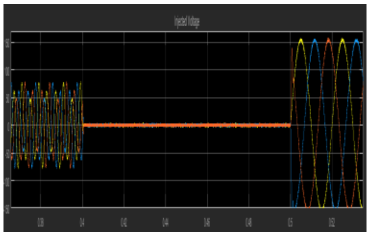

Fig. 4.4–Injected Voltage Output

The output power will not in constant always it will depend upon non-linear loads so reactive power of an series filter will act like the injected voltage in the power line.The y-axis indicating the amplitude of the power V=350.X-axis represent the time period in microsecond.The changes in the power source will vary the sinusoidal waveform.

V. HARDWARE DIAGRAM

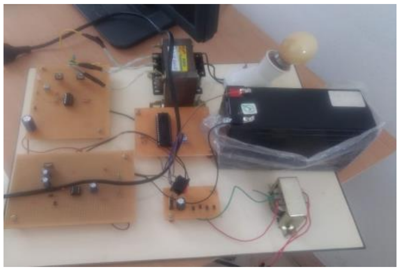

Fig. 5.1–Hardware Diagram

5. 1 DIAGRAM EXPLANATION

The Components used in the Diagram are Step down Transformer, Rectifier, PWM Inverter Board, Boost Converter, DC Link, Storage Unit&Output run lamp.

5. 2 HARDWARE OUTPUT DIAGRAM

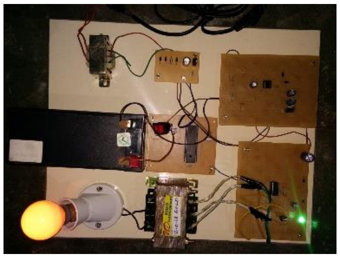

Fig. 5.2 –Hardware Output Diagram

5. 3 WORKING PRINCIPLE

The AC Current is collected through wind and collect it by Step down tansformer, we have to convert the AC Current into DC Current by using rectifier and Boost converter or Filter Circuit, A PWM inverter - 4047 is also used to carry the Converted DC Current from the rectifier, A DC link is used to carryover the current which is stored in a Storage unit called battery. With the help of Storage unit, We can get the output result of Lamping light. If we can not get the AC Current, we also run the output with the help of storage unit.

VI. CONCLUSION

This project presents a methodical study of a dynamic voltage restorer that can mitigate voltage sag at the load terminals due to fault occur at bus as well as along the line of a distribution system. The demonstrates the ability of the DVR through steady-state analysis. The proposed methodology can able to mitigate deep and long duration voltage sag. The mathematical models of DVR are described. Harmonic analysis is discussed with an experimental setup for generating online harmonic data. Placement of DVR is based on as per the maximum voltage sag occur for a particular topology. The algorithm proposed method versatile nonlinear modulation strategy (VNMS) algorithm used quality of power is recognized due to the various power line disturbances like voltage sag, swell, harmonics, methodologies are applied in distribution systems. The improvement in voltage sag performance after the installation of mitigation device(s) is not limited to the bus where a mitigation device is installed but improves the overall power quality of the system. The final goal of mitigation strategies is the reduction in process interruptions, making the total process disruption cost lower.

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