ELIMINATION OF VOLTAGE FLUCTUATION AND REACTIVE POWER COMPENSATOR IN MICRO GRID USING STATCOM

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ABSTRACT

Modern power system is a complex network comprising of numerous generators, transmission lines, and verity of loads and transformers . As a consequence of increasing power demand, some transmission lines are more loaded than was planned when they were built. With the increased loading of long transmission lines, the problem of transient stability after a major fault can become a transmission limiting factor. Now power engineers are much more concerned about transient stability problem due to back out in northeast United States, Scandinavia, England and ltaly. Micro grids are becoming increasingly attractive to consumers as it allows utilization of easily available renewable energy sources. They are usually installed at consumer's sites i.e. the distribution end. Due to high saturation of distributed generation units with different Types of loads, micro grids can cause power quality issues. Some of them are voltage swells and sags, and low power factor which further require reactive power compensation. This paper presents the utilization of the custom power device s pecifically STATCOM in mitigating the problem of voltage sags occurring in microgram. The performance of STATCOM, installed in micro grid, is analyzed for reactive power compensation to overcome these concerned issues. The design of a neural network controller using voltage as feedback for significantly improving the dynamic performance of converter. . A STATCOM injects an almost sinusoidal current of variable magnitude at the point of connection. This injected current is almost in quadrature with the line voltage there by emulating an inductive (or) a capacitive reactance at the point of connection with the transmission line.

Keywords: Statcom, Microgrid, Rectifier, Inverter, Micro controller .

I INTRODUCTION

Transient stability refers to the capability of a system to maintain synchronous operation in the event of large disturbances such as multi-phase short- circuit faults or switching of lines. power angle relationship stability depends upon both the initial operating conditions of the system and the severity of the disturbance recent development of power electronics introduces the use of flexible ac transmission system (statcom) controllers in power system STATCOM a, shunt compensation device

from the family of flexible alternating current transmission system (FACTS) the STATCOM is a solid-state voltage source Power quality is defined as the interaction of electrical power with electrical equipment. If electrical equipment operates correctly and reliably without being damaged or stressed, then the electrical power is good Quality. On the other hand, if the electrical equipment malfunctions and is damaged during normal usage, then the power quality is poor.

STATCOM VOLTAGE SOURCES

In addition to voltage source using batteries and capacitors, STATCOMs can be Operated with an inductor, which provides a source of direct current rather than Voltage, a three-phase, current-source converter then generates a set Of three-phase output currents which, by appropriate switching action, lag or Lead the system voltages. The basic output current is a square or block wave and harmonic reduction requires PWM, or multi-level or multi-phase techniques, and/or harmonic filters. The energy in the current source can be sustained by drawing energy from the supply system or by using an external energy source. However the losses of a current-sourced converter tend to be higher than those of voltage-sourced converter.

PROPOSED MODULATION TECHNIQUE

This technique involves the carrier based PWM. These are the classical and most widely used methods of pulse width modulation. They have as common characteristic sub cycles of constant time duration, a sub cycle being defined as the total duration *Ts* during which an active inverter leg assumes two consecutive switching states of opposite voltage polarity. Operation at sub cycles of constant duration is reflected in the harmonic spectrum by two salient sidebands, centered around the carrier frequency, and additional frequency bands around integral multiples of the carrier. The multi carrier modulation technique is very suitable for a multilevel inverter circuit. Buying this technique along with the multilevel topology, the low THD output waveform without any filter circuit is possible. Switching devices, in addition, turn on and off only one time per cycle. That can overcome the switching loss problem, as well as EMI problem. The PWM switching pattern developed for the proposed inverter is given below.

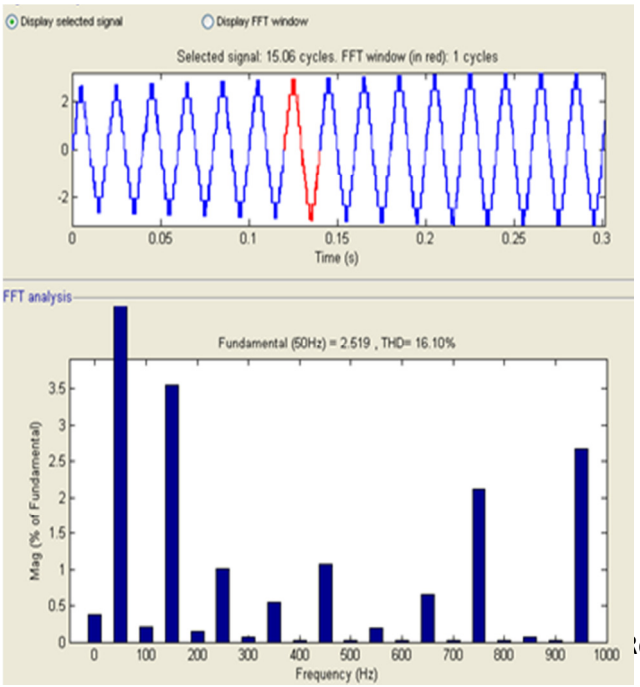
DESIGN OF STATCOM

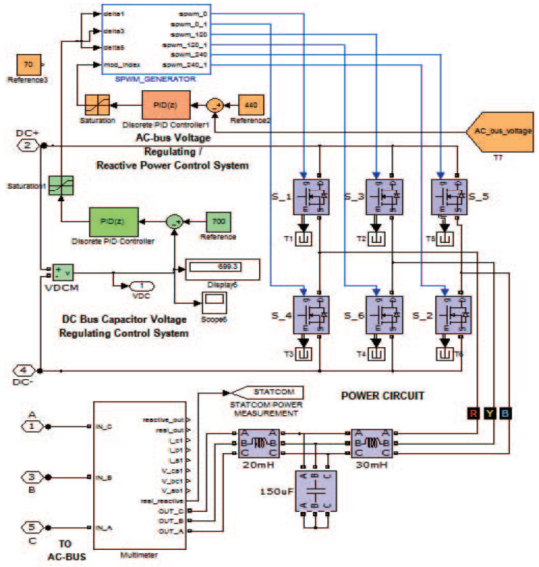
Micro grid has a AC-bus and DC-bus, interconnected together with a tie line DC -AC converter. AC-bus is connected to wind power plants, pico-hydro plant, local AC-loads and to the electricity grid with an islanding scheme. Power quality on AC bus has to be maintained in both the modes of operation of micro grid (islanded and non-islanded). Sudden islanding of utility grid creates significant voltage disturbances on AC bus. The AC bus has grid tie inverters AC-DC-AC converters, conventional synchronous generators as the sources supplying dynamic real power loads as well as reactive power loads. Supply of reactive power reduces the maximum amount of real

power that can be supplied of by the sources thereby resulting into poor utilization of their capacity. This provokes need of dynamic reactive power source on AC bus. The STATCOM (Static Synchronous Compensator) is known as a shunt-connected devices and reactive-power Compensation device that is capable of generating and absorbing reactive power and output can be varied to control the specific parameters of electric power system. A solid-state switching converter useful of generating or absorbing independently controllable real and reactive power and its output terminals. It is fed from an energy source or energy storage device at its input terminals.

STATCOM AND MICROGRID MODEL

An electrical grid is an interconnected network for delivering electricity from producers to consumers. It consists of generating stations that produce electrical power, high voltage transmission lines that carry power from distant source to demand converter, and distribution lines that connect individual customers. A smart gird is an electrical grid which includes a variety of operational and energy measures including smart meters, smart appliances, renewable energy resources, and energy. Electronic power conditioning and control of the production and distribution of electricity are important aspects of the smart Grid. STATCOM technologies for use in the high -voltage transmission system have already been well studied and presently in the step of practical use STATCOM applied to distribution systems requires some essential properties such as low cost, simple structure and space-saving design, the configuration of STATCOM developed for high-voltage transmission system may be impractical for distribution. Taking consideration of this aspect, we have proposed a STATCOM for distribution system based on the existing technologies for STATCOM of large capacity and high-voltage.





This paper presented an eleven-level cascade H-bridge inverter, which uses PLL and MPPT with separate solar panels as DC sources to interact with the power grid.The proposed system demonstrates the application of a new inverter with FACTS capability in a single unit without any additional cost. Replacing the traditional renewable energy inverters with the proposed inverter will eliminate the need of any external STATCOM devices to regulate the Reactive power of the grid. Clearly, depending on the size of the compensation,

PROPOSED SYSTEM

Micro grid has a AC-bus and DC-bus, interconnected together with a tie line DC -AC converter. AC-bus is connected to wind power plants, pico-hydro plant, local AC-loads and to the electricity grid with an islanding scheme. Power quality on AC bus has to be maintained in both the modes of operation of micro grid (islanded and non-islanded). Sudden islanding of utility grid

CONCLUSION

This paper presented an eleven-level cascade H-bridge inverter, which uses PLL and MPPT with separate solar panels as DC sources to interact with the power grid.The proposed system demonstrates the application of a new inverter with FACTS capability in a single unit without any additional cost. Replacing the traditional renewable energy inverters with the proposed inverter will eliminate the need of any external STATCOM devices to regulate the Reactive power of the grid. Clearly, depending on the size of the compensation, multiple inverters may be needed to reach creates significant voltage disturbances on AC bus. The AC bus has grid tie inverters AC-DC-AC converters, conventional synchronous generators as the sources supplying dynamic real power loads as well as reactive power loads. Supply of reactive power reduces the maximum amount of real power that can be supplied of by the sources thereby resulting into poor utilization of their capacity.

Multiple inverters may be needed to reach the desired THD. This shows a new way in which distributed renewable sources can be used to provide control and support in distribution systems. The proposed controller system adjusts the active power by changing the power angle (delta) and the reactive power is controllable by the modulation index m. The entire PV system structure and itsinteraction with the grid through PLL and MPPT algorithms were shown by the simulation and experimental results.

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