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Reactive Power Supply of Single Phase with Grid Connected PV Systems

G. Bagyalaxmi*, S.Sarala
*PG Scholar, M.Tech, Assistant Professor (Ph.d),
Siddartha Institute of Technology, Narapally, Hyderabad, TS, India

Abstracts

This paper proposes FACT device for Micro grid applications. This device is used to improve the reliability and power quality of the overall micro grid loads. In order to obtain faster computational time for large power systems, by resolving the steady-state and the transient control problems separately, a novel control design used in this new model of control algorithm. To demonstrate the capability of the proposed flexible ac distribution system device this design concept is verified through different test case scenarios and the results obtained are discussed.

Keywords: PV systems, Power supply, Synchronous reference frame (SRF).

Introduction

A Micro grid is a localized grouping of electricity generation, energy storage, and loads that normally operate connected to a traditional centralized grid (macrogrid) and microgrid has offered consumers with reduction in total energy losses, and with increased reliability and has become an alternative for traditional power distribution system The impact of power quality (PQ) problems on the overall power system performance depends on concepts of a microgrid distribution grid. These power quality problems dependent on some of the electrical parameters like voltage and frequency. In order to overcome power quality problems, some of power conditioning devices such as active filters, dynamic voltage restorers (DVR), uninterruptible power supplies (UPS), and several unified PQ conditioners are usually employed by users to protect their loads and systems against power quality disturbances in the overall power system. , these equipments are usually installed at the load sides This concept proposes a FACT device for the micro grid that is realized using a combination of series and Parallel voltage source inverters. The proposed flexible ac distribution system device is connected at the PCC of the distribution network that the micro grid and other loads are connected to. In this project sources are a photovoltaic (PV) array and a battery to store the excess energy generated by the PV array and to provide power during sunless hours. By use of this device we can get improved the Power Quality and reliability of the micro grid. The proposed Fact device can provide active and reactive power to the micro grid. To track periodic reference signals for fast sampling linear time invariant systems that are subject to input, in this project a modified controller is based on a newly developed model predictive control algorithm. This project steady-state and transient sub problems which are optimized separately. In this way, so that computational times can be reduced greatly been proposed for single phase rooftop PV grid connected system. The VSC controller is designed in taking the advantage of both current and voltage controller which is called current driven PWM based voltage controller. Through the VSC the maximum tracked power is pumped into the grid through proper control on DC link voltage. By maintaining the DC link voltage constant during operation, is ensured the total power being generated by PV transferred across the DC bus by the inverter to the grid. Apart from active power transfer the system could be well utilized for providing limited reactive power compensation based on available capacity of the VSC. The detailed system configuration and various control schemes are briefly discussed and explained.

Control strategy

The configuration proposed Fact device is shown below. The proposed micro grid consists of three feeders here feeders 1 and 3 are each connected to a DG unit consisting of a Micro generator, a three phase Voltage Source Inverter, and a three-phase LC filter. Feeder 2 is connected to a load.. The Fact device is operated in two modes: 1) Power Quality compensation and 2) important emergency operation. During grid-connected operation, the micro grid is connected to the distribution grid at the Point of Common Coupling. In this mode, the two distributed generation units are controlled to provide local power and voltage support for loads 1–3 and hence reduce the load of generation and delivery of Power directly from the utility grid. The FACT device functions to Limit harmonics in the currents drawn by the several loads in the micro grid so

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that the harmonics will not effected to the rest of the loads that are connected to the Point of Common Coupling.

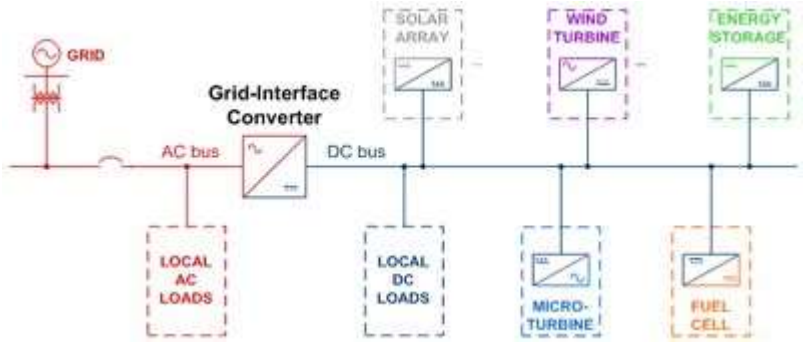

Fig 1.0 Micro grid architecture

In the model we are utilizing a PLL for synchronization of the series APF to the system. And with the use of parks transformation we are obtaining dq0 parameters from abc, in order the redefine the direct and quadrature axis components of the system. The equations used in the system are, The voltage requirement is calculated by using the inverse parks transformation after the LPF from the direct axis component to reduce the ripple in the generated reference current. Pulses produced by the generator are given to the IGBT inverter which induces voltage into the system.

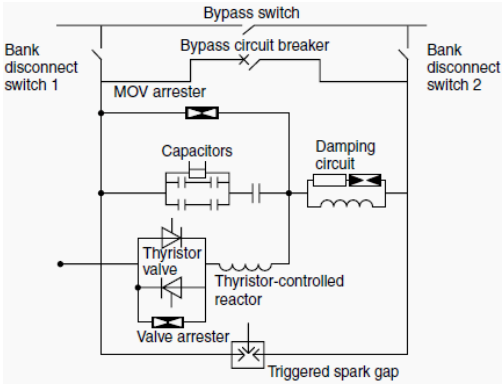

Fig 2.0 Three phase flexible system

UPQC system design

With all the control structures and active power filters we are now constructing a four wire UPQC system as shown in the fig. below we have a dc link capacitors of two where the midpoint is connected to ground. The left APF is series and the right is shunt. We use IGBT and a parallel diode as a switch.

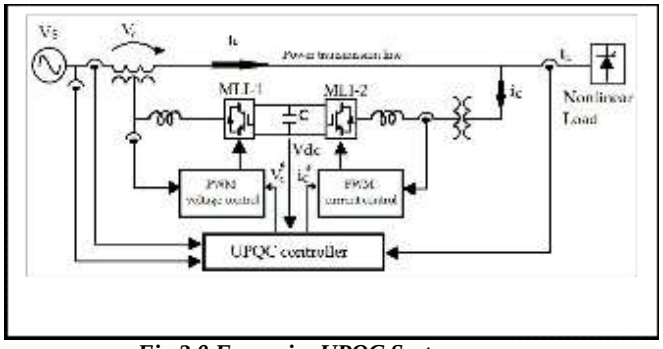

Fig 3.0 Four wire UPQC System

Experimental results

In order to verify the effectiveness of the above soltions, the experimental tests are carried out. And the system parameters are listed in Table

U_{dc}	120V	I	8A
$u_{abc,o}$	50V	k_{ip}	0.1
L_{abc}	5mH	k_{ii}	20
C_{abc}	9.4 μF	k_{vp}	1
R	1Ω	k_{vi}	20
L	3mH	R_{load}	9Ω

Where kip and kii are the proportional and integral gains of the current loop; kvp and kvi are the proportional and integral gains of the voltage loop. *I* represents of rated current of the inverter. R represents of the load connected at PCC. The line impedance R/X ratio is set as 1 to test the effect of the line impedance ratio on the voltage regulation.

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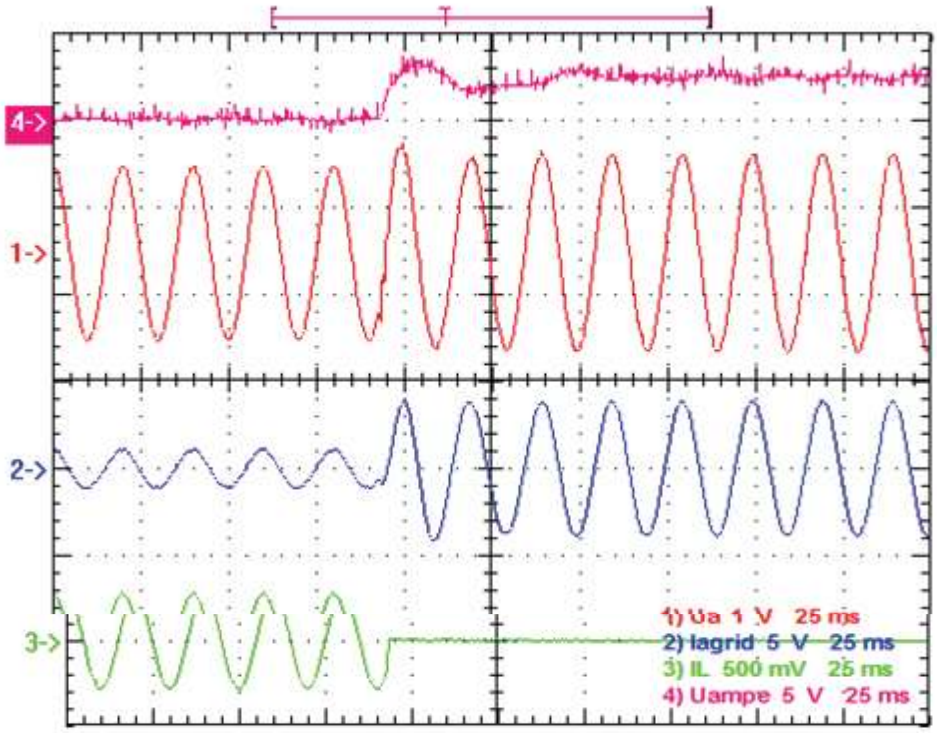

Conclusion

The simulated results clearly demonstrates the ability of the proposed control scheme to evacuate MPP tracked power from the PV array and provide limited reactive power compensation with grid connected mode. The MPPT used in the control tracks the power very fast even under step change of insulation, and the current controlled PWM controller inject adequate generated current for self support of capacitor at DC bus and thereby providing storage less operation. Single phase SRF based estimation is employed which provides rugged control with cost effective solution. The proposed SRF based approach enable the control for providing limited Compensation of reactive power depending on available unutilized capacity of VSC. The implemented scheme derives = = the advantage of simplicity and is capable of delivering under varying insolation conditions effectively. Such technique is envisaged to benefit the PV rooftop system and grid/micro grid by the limited compensation, thereby effectively utilizing the connected hardware. It is operates as a distributed generation unit under emergency condition. The design configuration is simulated and tested using matlab simulink software so that the flexible ac distribution system device is able to tackle a wide range of Power Quality problems, finally with this Fact device Power Quality and reliability The simulation results obtained in this paper and the current analysis serve as a fundamental step toward the design of control circuits for hardware implementation of the device in the future.

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