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REACTIVE POWER SHARING IN PV MICRO GRID FOR ISLANDING OPERATION

MOHAN.E [1], MOHANKUMAR.G[2]

[1]P.G Scholar, Department of EEE, PRIST UNIVERITY, Thanjavur, Tamil Nadu (Puducherry Campus)
[2]Assistant Professor& Head, Department of EEE, PRIST UNIVERITY, Thanjavur, Tamil Nadu (Puducherry Campus)

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Abstract – *In this paper, control strategy of reactive power sharing in an islanded micro grid concept is proposed. In order to compensate for the mismatch in voltage drops across feeders Communication through virtual impedances is proposed. Accurate reactive power sharing is possible even if communication is disrupted once the virtual impedance operated on load operating point. In addition, the reactive power sharing accuracy supported the proposed strategy is resistant to the time delay. The proposed model will be developed using MATLAB/Simulink and the sensitivity of the tuned controller parameters to changes in the system operating point is also explained.*

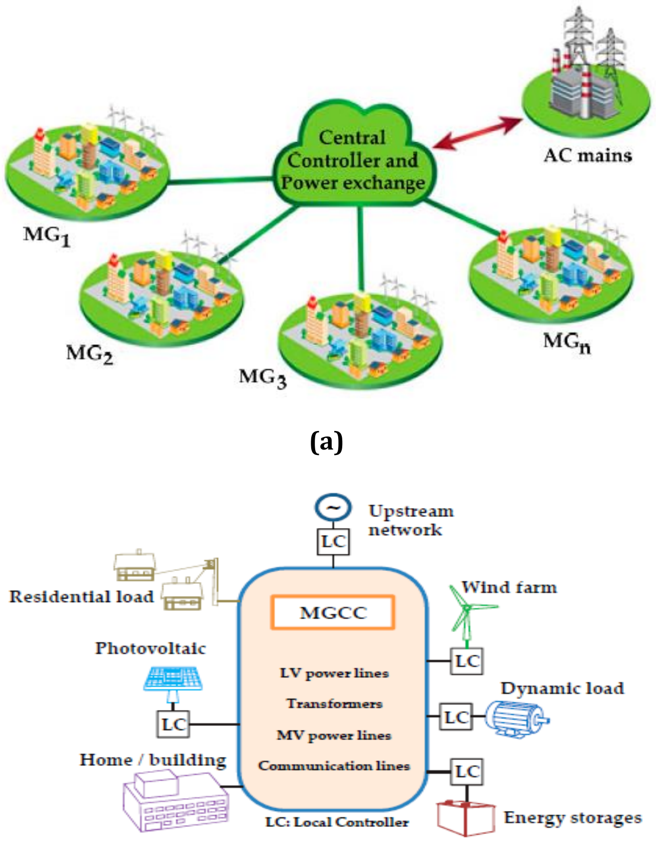
***Key Words*:** *Reactive power, Microgrid,* Energy Storage, *Voltage Control, Power Quality*

1.INTRODUCTION

Human beings will need to find alternative energy sources to avoid this disaster since Fossil fuel reserves are going to vanish in the near future. Conventional energy sources like fossil fuel have environmental impacts and rise in price, now focus should be shifting to the fast developing renewable and sustainable energy sources. A renewable energy source becomes so popular with fossil fuels depletion. The renewable energy sources have kept them from integrating with the utility grid due to unpredictable and intermittent nature.

Microgrids (MG) have been widely used in electric systems because of global increasing energy demand, and the worldwide concern about the environment issue caused by fossil fuels power generation. MG can include different renewable energy sources, which supplies energy by a primary source and distributed storage characterized by utilizing energy storage system and electric vehicles. Renewable energy sources and their integration into grid have a very critical role in energy management system applications. By enabling this integration, micro-grids consisting of renewable energy sources, energy storage units, and load components are emerging as a new and effective solution to today's electric power system networks. The reliability of the microgrids system as well power quality issues can be minimized to have large power capacity and more control flexibility.

The load power in the microgrid should be properly shared by multiple DG units during island operation. By the droop control method active power sharing is always achieved easily. However, the reactive power will not be shared accurately due to effects of mismatched feeder impedance between the DG and loads. A new reactive power sharing method is proposed in this paper in order to avoid severe circulating reactive power and stability problems during extreme situations.



(a)

(b)

Figure 1. (a) Power exchange for microgrids (MGs) (b) equipment of a typical MG

2. MICROGRID AND ISLANDING TECHNIQUE

The popularity of distributed generation systems because of their higher operating efficiency and low emission levels is growing faster from last few years. Several micro sources for their operation like photovoltaic cells, batteries, micro turbines and fuel cells make use of Distributed generators. By combining cluster of loads and parallel distributed generation systems microgride in a certain local area can be build. The reliability of the microgrids system as well power quality issues can be minimized to have large power capacity and more control flexibility.

Implementation of high performance power control and voltage regulation algorithm needs Operation of microgrid. Microgrid is proposed in order to realize the emerging potential of distributed generation system. Local reliability can be higher in microgrid than the whole power system during disturbances by islanding generation and loads. For grid connected or islanded mode of operation, microgrid operation becomes highly flexible and can be operated freely.

The main considerations of detecting an islanding situation are to monitor the system parameters DG output parameters and decide from change in these parameters whether or not an islanding situation has occurred. Figure 2 shows the Islanding detection techniques can be divided into remote and local techniques and local techniques can further be divided into passive, active and hybrid techniques.

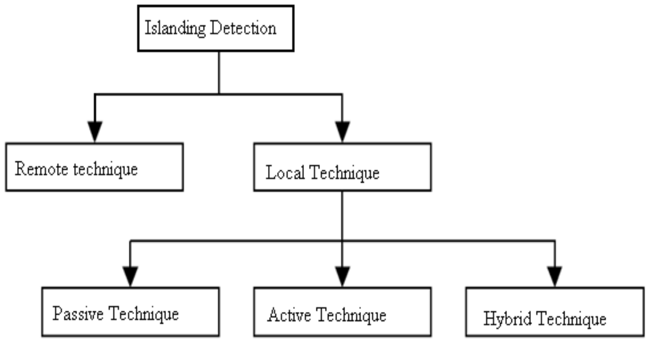


Figure: 2 Islanding detection techniques

3. ANALYSIS OF THE HIERARCHICAL CONTROL SCHEME FOR MICROGRIDS

Figure 3 shows islanded microgrid general configuration with the hierarchical control scheme. An energy source, an inverter and a local controller are present in each Distributed Generation and are connected to the microgrid common bus through a feeder. Isolation transformer impedance and transmission cable impedance should present in the feeder impedance. The autonomous operation of each DG local controller based on hierarchical control scheme, the primary control works in a decentralized manner should implement the centralized secondary control loop and remote sensing block measures the microgrid status. Through a communication network primary control in each DG unit sent compensation signals that Microgrid central controller generates.

The proposed system should involve power production, fast load tracking and microgrid voltage and frequency support. Voltage and current control loops, virtual impedance loop, and droop control loop should include in the primary control. Real and reactive power can be controlled by the droop control system by adjusting the amplitude of the voltage reference and phase angle. This control behavior imitates of a synchronous generator and allows multiple DG units parallel operation.

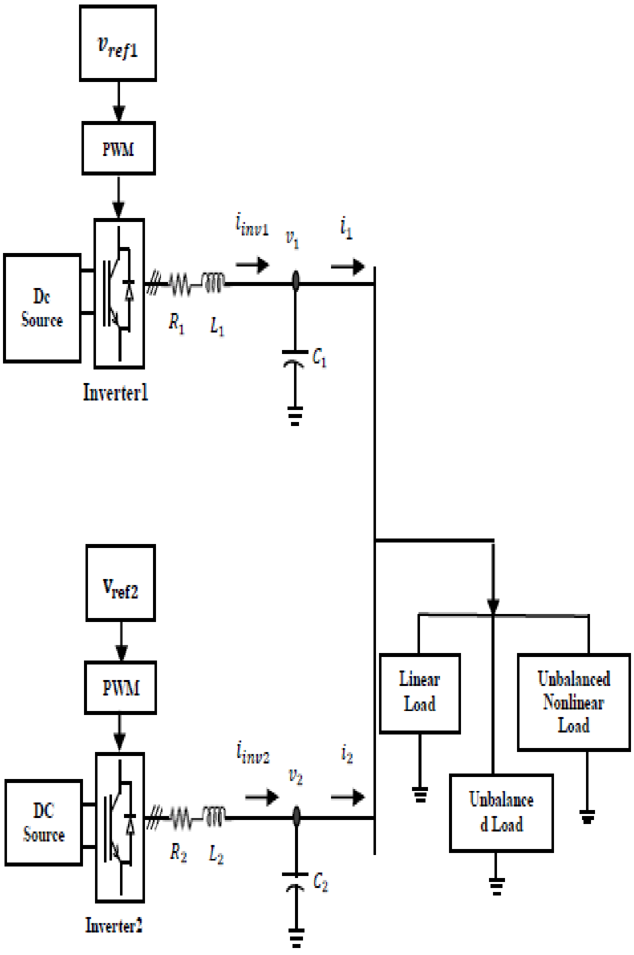


Figure 3 Islanded microgrids with control scheme

4. SIMULATIONS AND RESULTS

The islanded microgrid model discussed is simulated in the MATLAB/Simulink environment to validate the proposed control strategy as shown in figure 4.

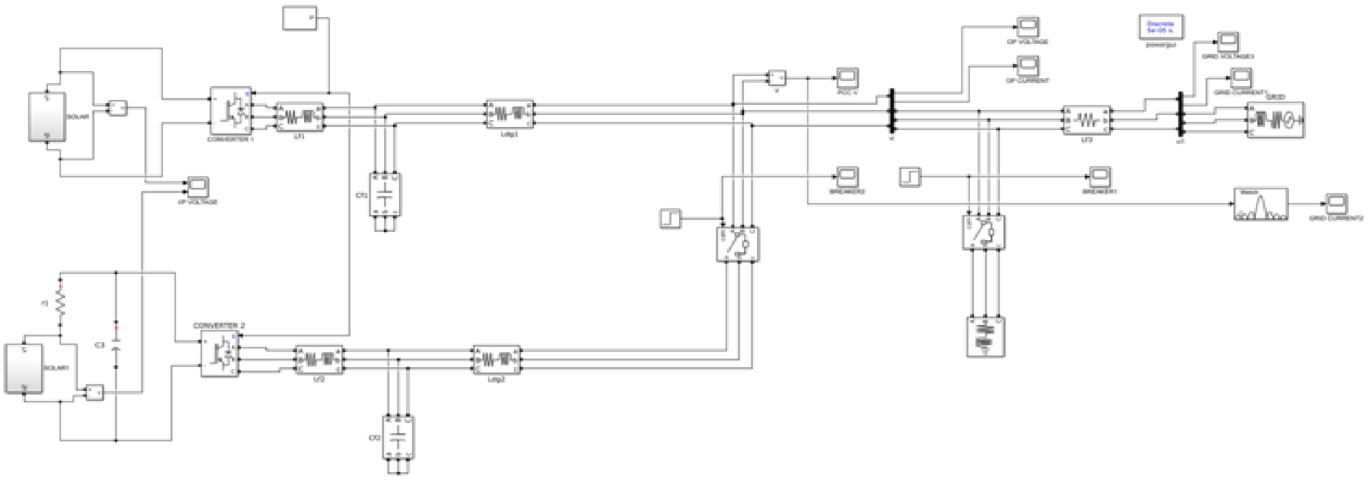


Figure 4 Simulation circuit with islanded microgrid model

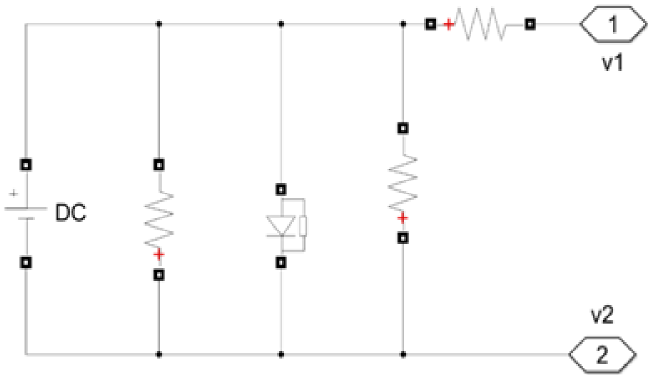


Figure 5 Solar Model

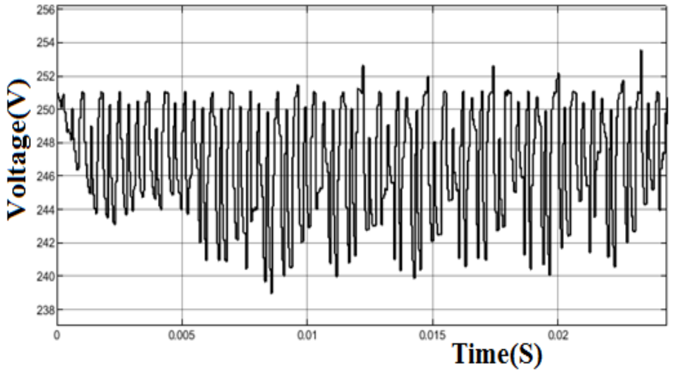


Figure 7 Solar Input Voltage-II

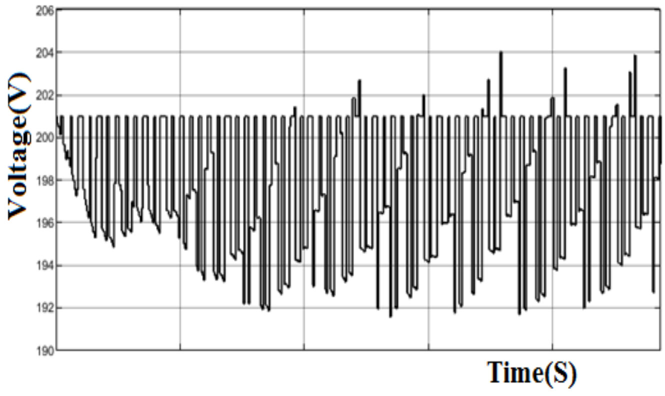


Figure 6 Solar Input Voltage-I

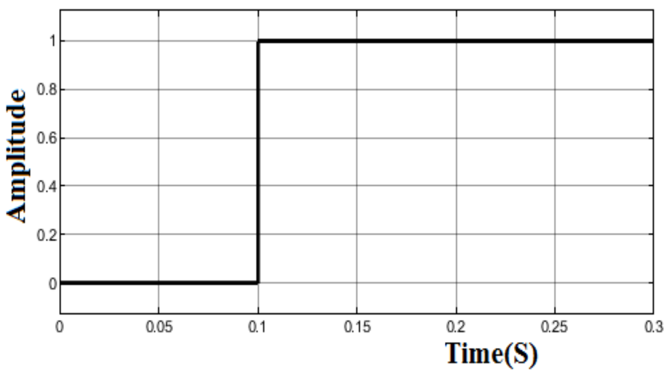


Figure 8 Step Input to Breaker Switch-I

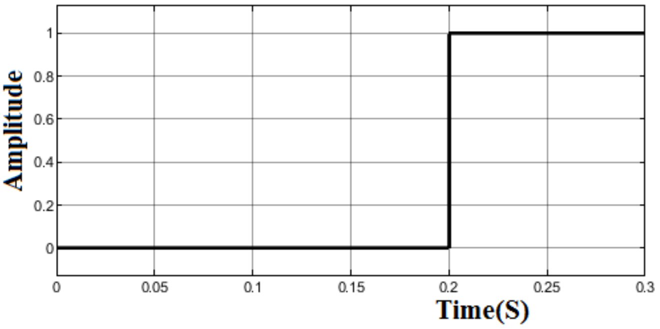


Figure 9 Step Input to Breaker Switch-II

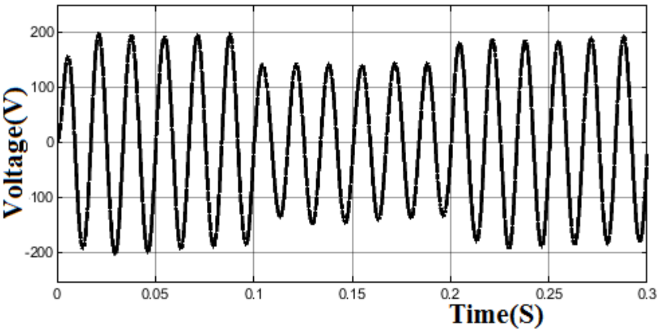


Figure 10 Voltage Across Point of Common Coupling (PCC)

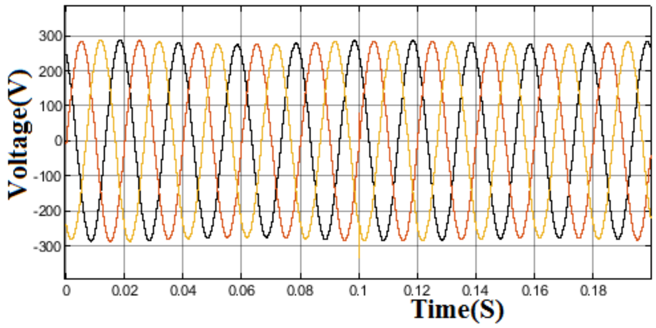


Figure 11 Grid Voltage (3 phase)

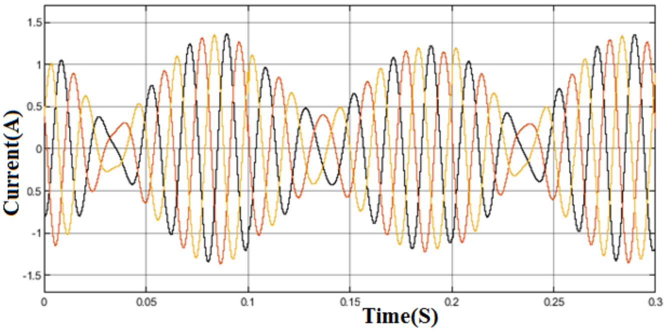


Figure 12 Grid Current (3 phase)

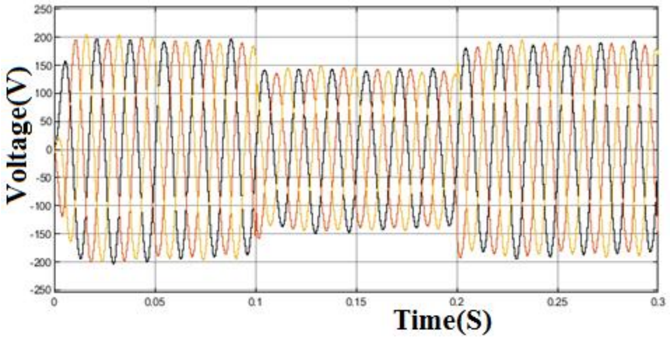


Figure 13 Output Voltage (3 phase)

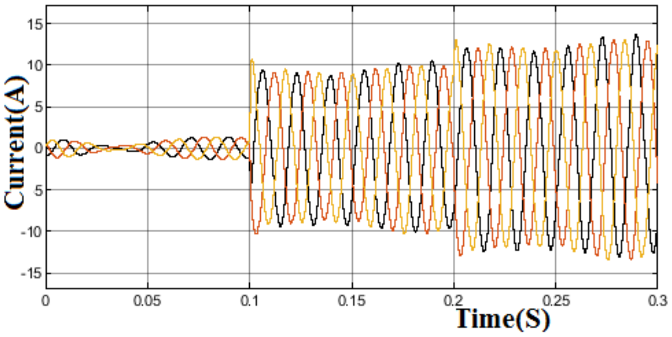


Figure 14 Output Current (3 phase)

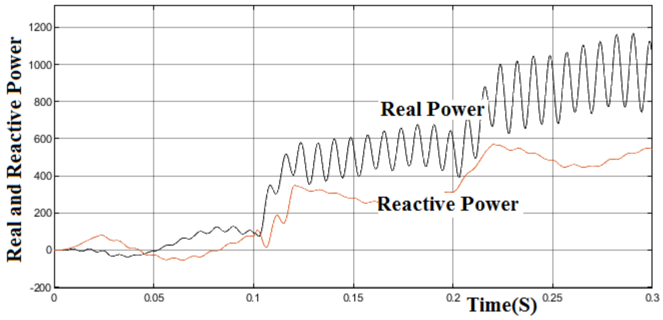


Figure 15 Real and Reactive Power

5. CONCLUSION

In this paper, control strategy of reactive power sharing in an islanded micro grid concept was proposed and simulated and its characteristics were verified. The control strategy improve reactive power sharing in an islanded microgrid are verified. The sensitivity of the tune controller parameters to changes in the system operating point and has been shown that the system operating point is mainly less sensitive to the parameter at operating point.

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BIOGRAPHIES

E.MOHAN received the Engineering degree in the year of April-2003 from Kamaraj University, Madurai, Tamilnadu. Worked as Assistant Engineer in TANGEDCO's various departments such as O&M, Operations Lines etc from March 2006 to March 2018. Currently working as an Assistant Executive Engineer in TANGEDCO's O&M Ulundurpet, Tamilnadu. His specialization in TANGEDCO operation and maintenance of distribution networks.