INCREMENTING MAXIMUM POWER FLOW CONTROL FOR DC MICROGRIDUSING MPPT TECHNIQUE

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Abstract
A DC micro grid has low inertia and is dominated by power converters. Because of this, the DC voltage change rate under power fluctuation is highly rapid. In this research, an incremental conductance maximum power point monitoring algorithm control is recommended to enhance the inertia of the dc micro grid and lower the change rate of the dc voltage. Today's DC demands are multiplying quickly, and DC micro grids powered by renewable energy sources are emerging as a viable solution to the world's growing energy needs. Management of power flow among the sources is crucial because many energy sources, such as solar, wind, fuel cells, and diesel generators, may be introduced into the DC grid. In this article, a management approach for the DC micro grid is presented power flows with solar and wind energy sources. A dedicatedconverter is to be used to maintain the DCconnection voltage as the control of voltageprofile is necessary in a standalone system.The battery circuit controls the DC connection voltage while maximum poweris collected from solar and winds to feed theloads attached to the DC bus. To monitorthree sources in the DC Micro grid, an Incremental Conductance Maximum Power Point Tracking Algorithm is developed. In MATLAB/SIMULINK, the Incremental conductance maximum power point monitoring algorithm is checked for different load conditions and for variationsin solar and wind power.
Keywords: DC micro grid; Power flow,Photovoltaic's, Wind conversion systems.

INTRODUCTION

As the use of fossil fuels declined, the need for energy increased, pushing people to turn to renewable energy sources. Utilizing solar and wind energy for electricity is now viable because to new advances in semiconductor technology. The AC power is often converted into DC inside the system to provide loads since the bulk of electronic loads demand a DC source. The majority of electronic loads are also offered. It is feasible to provide DCs directly to homes and structures. The direct current distribution system structure is ideal for a micro grid. The term "micro grid" refers to a low voltage autonomous cluster that is produced by distributed generation, mostly using renewable energy sources like solar, wind, and hydropower, as well as energy storage systems and local storage systems. In distribution networks with the incorporation of renewable energy sources, DC micro grids are pointed out as a good option. Today, the latest technical developments and new directions in technology. Control on electricity stimulates a substantial increase Distributed generation (DG) capital worldwide. To effectively utilize the available renewable energy sources, it is necessary to always operate in MPPT mode. In standalone systems, maintaining the voltage profile is done by sacrificing the MPPT mode. In this paper, a battery charger/discharger circuit used to regulate the DC link voltage while extracting the maximum from renewable energy sources. Depending on the availability of the solar and wind power while taking into account the load demand and battery voltage, the developed Management of power flow algorithm will determine the mode of operation to ensure reliable and uninterrupted power to the load. To monitor three sources in the DC Micro grid, an Incremental Conductance Maximum Power Point Tracking Algorithm is developed.

RELATED WORK

The DC Micro grid consists of a solar PV array, a wind energy conversion system, a battery bank, and a DC bus interface power converter. The DC Microgrid block diagram considered for the analysis is shown in Fig.1.

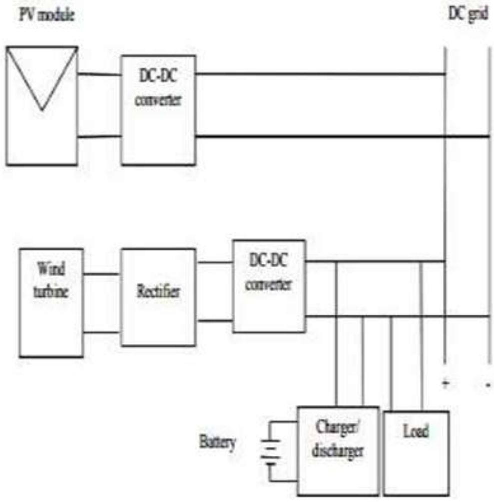


Fig. 1 Block diagram of the DC micro gridwith Solar and wind energy sources

The wind turbine power is generated by the induction generator. The power generated from the induction generator is rectified to DC and through a power converter, fed into the DC bus. The MOSFET is used for the purpose of switching. The output isconnected to the DC micro grid from theDC-DC boost converter where the loads are connected. The battery work is carried out by a DC-DC boost converter that also regulates the voltage of the DC connection.

Distributed generator

Model of Wind and Solar System

As distributed generators, a solar system anda wind system are introduced. The solar system is created by a boost converter connected to photovoltaic arrays. The radiance profile, G, is taken as the input to emulate the PV system, and the output power is calculated to be processed by the converter control in which the wind speed, Vw, is the input of the wind system. The created AC power is converted to DC by a rectifier, so the same control process appliedto the PV system is applied to the wind structure. The output power is processed via the control of the converter.

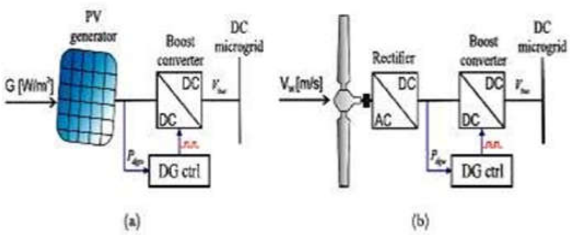


Fig 2. Distributed generation system (a) PVsolar system. (b) Wind system

MPPT:

The Maximum Power Point Tracker (orMPPT) is a high-efficiency DC to DC converter that provides a solar panel or arraywith an ideal electrical load and generates a load-appropriate voltage. For a full array asa whole, conventional solar inverters perform MPPT. The same current, determined by the inverter, flows through allpanels in the chain in such systems. But since different panels have distinct IV curves, i.e. different MPPs (due to production tolerance, partial shading, etc.), this architecture ensures that certain panels can perform below their MPP, resulting in energy loss. In the DC side, continuous power is avoided assistance in power flow algorithm management the battery regulates the DC link voltage. Hence maximum poweris extracted from solar and wind energy systems.

INCREMENTAL CONDUCTANCEMETHOD:

This approach consists of using the slope of the current derivative relative to the voltage to achieve the maximum power point. In the real world, what value MPPT offers depends on the collection, itsenvironment, and its seasonal load pattern. Only when the Vpp is more than about 1V higher than the battery voltage does it giveus an important current boost. This mightnot be the case in hot weather unless the batteries have a low charge. The Vpp will increase to 18V in cold weather, however. Ifthe use of energy is highest in the winter (typical in most homes) and the winter weather is cold, when it is most needed, the energy will increase considerably.

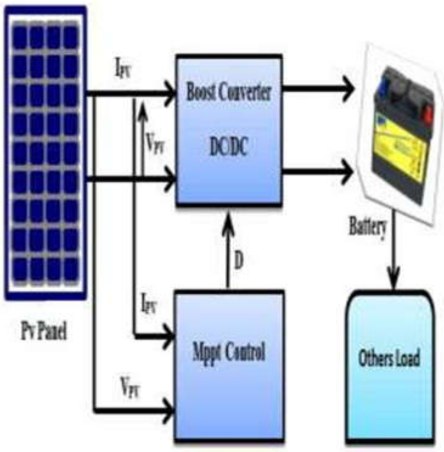


Fig.3: PV System with Power Converter andMPPT Control

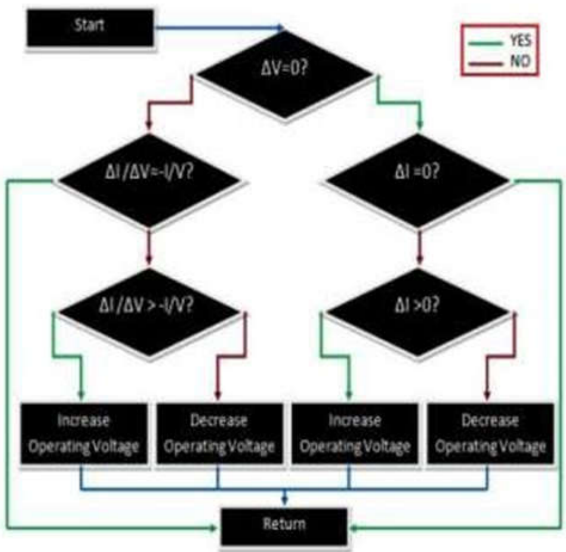


Fig 4: Organigram of incremental Inductancealgorithm

Where, $P = V \times I$

$$\begin{cases} \frac{\Delta I}{\Delta V} = -\frac{I}{V} & \text{at the MPP} \\ \frac{\Delta I}{\Delta V} > -\frac{I}{V} & \text{left of the MPP} \\ \frac{\Delta I}{\Delta V} < -\frac{I}{V} & \text{right of the MPP} \end{cases}$$

MPP can be monitored by comparing instantconductance with incremental conductance

RESULTS AND DISCUSSION

The DC Micro grid consists of a wind generator with 700 W PV array and 500 W. A boost converter links the PV array to the 48V DC bus. A rectifier attaches the induction generator to the DC bus. The MPPT algorithm is used by Incremental Inductance. A 24V battery connects to the DC connection through a charger/discharger circuit. The charger circuit regulates the DC link voltage.

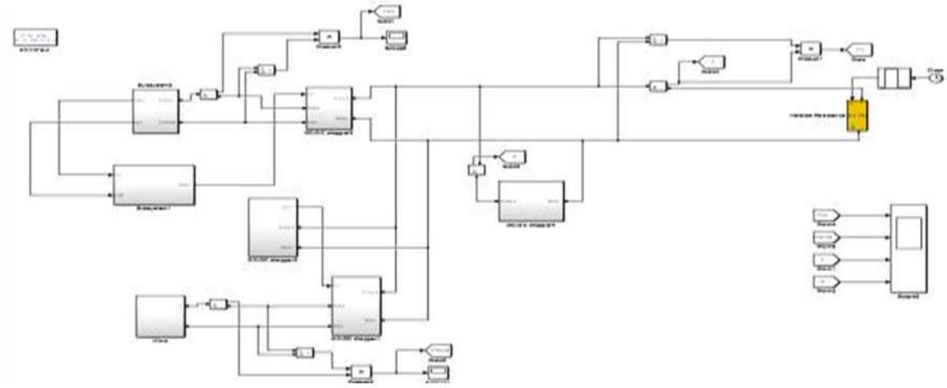
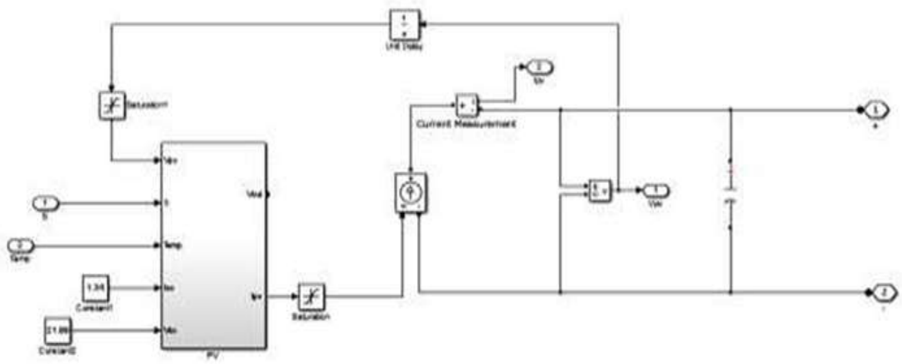
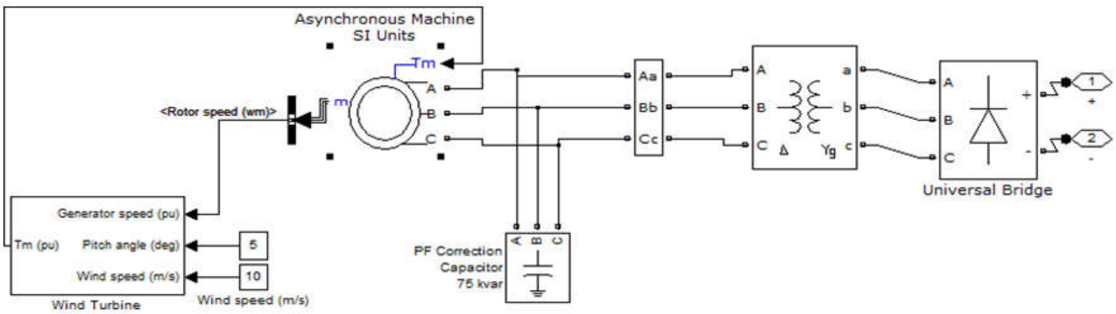


Fig 5 Simulink model of the developed DC Micro gridSOLAR POWER GENERATION:



WIND POWER GENERATION:



MPPT-INCREMENTAL CONDUCTANCE:

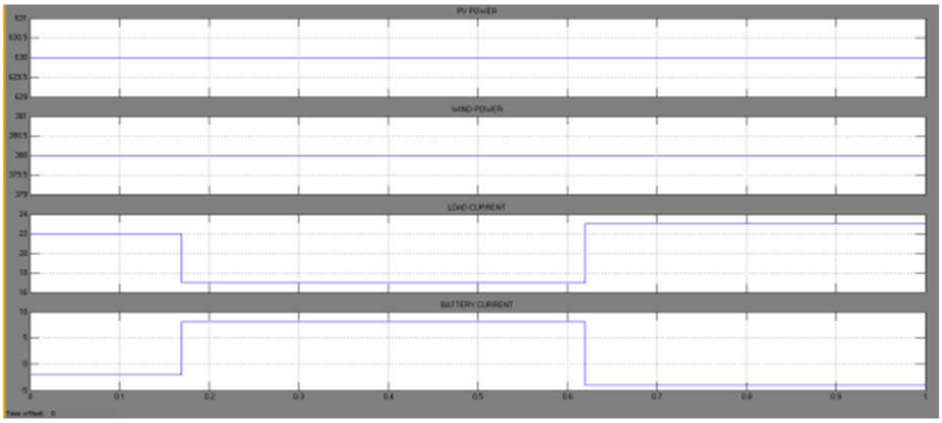


Fig 6: Response of the system for increase& decrease in load power

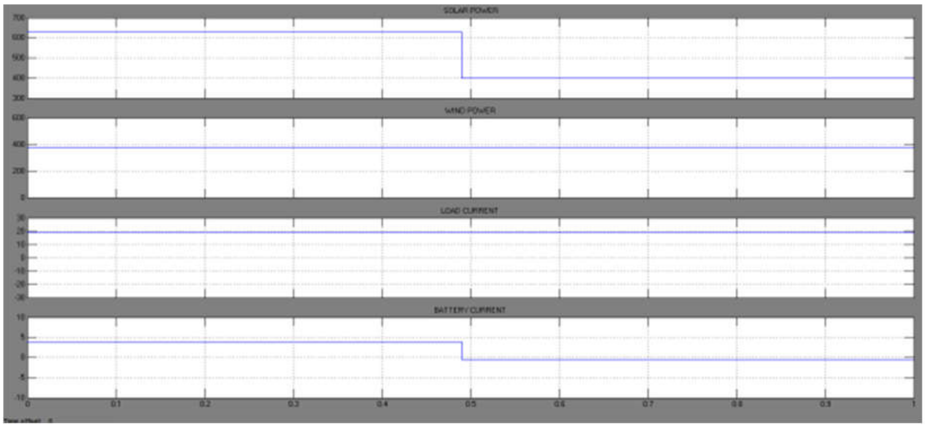


Fig 7: Response of the system during change in Ppv

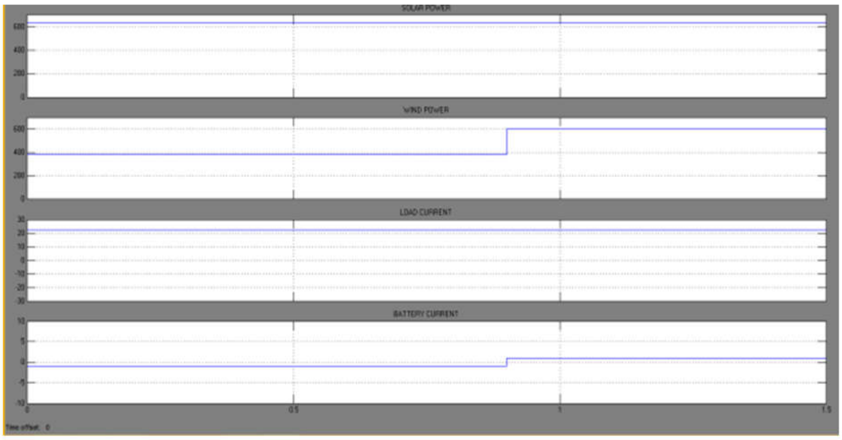


Fig 8: Response of the system during change in Pw

Change in load power:

The power from the solar panel (PPV) supplies 630W and the power (PW) from the wind turbine provides about 380W.If the load current (IL) decreases, i.e. the load demand decreases, then the excess energy is used to charge the battery in charging mode The power from the solarpanel (PPV) supplies 630W power and the power (PW) from the wind turbine provides about 380W., when the load current (IL) rises, i.e. the demand for load increases, the battery operates in discharge mode to supplythe deficit power.

Change in PV power

The power generated from the solar panel (PPV) is reduced from 630W to 415Wand the wind turbine produces the same power of 380W in order to research the response of the system to changes in input power. The battery works in the discharging mode to provide uninterrupted power to the load.

Change in Wind power

As the wind turbine (PW) generated power raises from 380W to 590W and the solar panel generates 630W of the same power, the additional power generated is used to charge the battery.

Conclusion

A maximum power point monitoring algorithm control method for the DC micro grid with solar and wind power sources is proposed for power flow management and incremental conductance. In this study, it is recommended to use an incremental conductance maximum power point monitoring algorithm control to slow down the rate at which the dc voltage changes and enhance the inertia of the dc micro grid. A maximum power point monitoring control method for the DC micro grid must be created since the plan uses various intermittent energy sources and loads with variable demands for power flow management and incremental conductance. In order to provide the loads with unceasing power supply and balance the power flow between the different sources at any time, a power flow algorithm management and incrementalconductance maximum power point monitoring control algorithm for the DC micro grid is developed.

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