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MPPT FOR DC DC-DC CONVRTER FOR PHOTOVOLTAIC APPLICATIONS

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ABSTRACT

Photovoltaic (PV) energy is the most important energy resource since it is clean, pollution free, and inexhaustible. In recent years, a large number of techniques have been proposed for tracking the maximum power point (MPP). Maximum power point tracking (MPPT) is used in photovoltaic (PV) systems to maximize the photovoltaic array output power, irrespective of the temperature and radiation conditions and of the load electrical characteristics the PV array output power is used to directly control the dc/dc converter, thus reducing the complexity of the system. The method is based on use of a Incremental conductance of the PV to determine an optimum operating current for the maximum output power.

***Keywords*---Photovoltaic System, Modeling of PV Arrays, Incremental conductance Algorithm, Boost Converter and Simulation Results**

I.INTRODUCTION

Renewable sources of energy acquire growing importance due to its enormous consumption and exhaustion of fossil fuel. Also, solar energy is the most readily available source of energy and it is free. Moreover, solar energy is the best among all the renewable energy sources since, it is non-polluting. Energy supplied by the sun in one hour is equal to the amount of energy required by the human in one year. Photo voltaic arrays are used in many applications such as water pumping, street lighting in rural town, battery charging and grid connected PV systems.

As known from a Power-Voltage curve of a solar panel, there is an optimum operating point such that the PV delivers the maximum possible power to the load. The optimum operating point changes with solar irradiation and cell temperature. This paper deals with Incremental conductance MPPT algorithm method due to its simple approach [1].

1.1 OBJECTIVE:

To continously run a dc motor, using solar power its not possible, because the solar power will not be constant at all time, so I have chosen a mppt incremental conductance to account the varying voltage and run the dc motor if the weather condition vary.

1.2 ADVANTAGES

- Voltage ripple is reduced
- Solar cells make absolutely no noise at all.
- Solar energy creates absolutely no pollution.
- Very little maintenance is required to keep solar cells running
- The IncCond method has the advantage over the P&O of not oscillating around the MPP under rapidly changing environmental conditions, but has a more complex circuitry.

1.3 APPLICATIONS

- Architecture and urban planning
- Agriculture and horticulture
- Solar lighting
- Water heating
- Cooking
- Solar vehicles

2. BLOCK DIAGRAM

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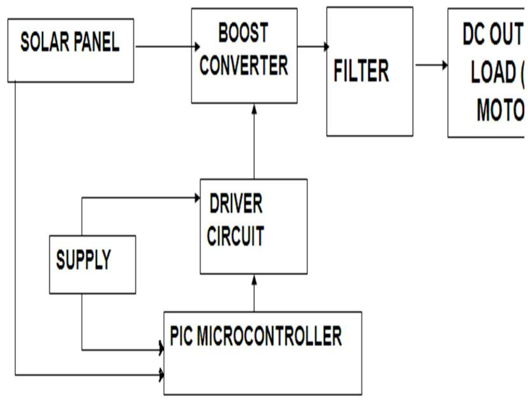
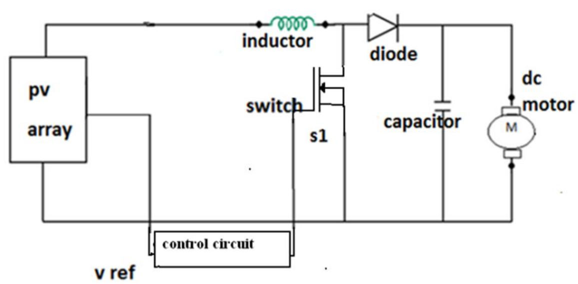


2.1 CIRCUIT DIAGRAM



MODE:1

- When s1closed the inductor gets charged through the battery and stores the energy.
- The diode blocks the current flowing and so the load current remains constant which is being supplied due to the discharging of the capacitor.

MODE:2

- The switch is open and so the diode becomes short circuited. The energy stored in the inductor gets discharged through opposite polarities which charge the capacitor.
- The load current remains constant throughout the operation.

3. INCREMENTAL CONDUCTANCE MPPT

- In incremental conductance method the array terminal voltage is always adjusted according to the MPP voltage it is based on the incremental and instantaneous conductance of the PV module.

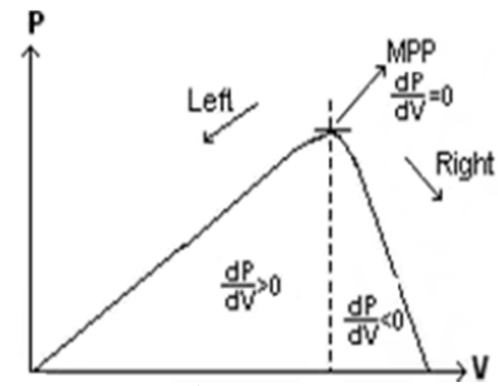


Fig-6 shows that the slope of the P-V array power curve is zero at The MPP, increasing on the left of the MPP and decreasing on the Right hand side of the MPP. The basic equations of this method are as follows.

/ =− / At MPP (1)

/ >− / Left of MPP (2)

/ <− / Right of MPP (3)

Where I and V are P-V array output current and voltage respectively. The left hand side of equations represents incremental conductance of P-V module and the right hand side represents the instantaneous conductance. When the ratio of change in output conductance is equal to the negative output conductance, the solar array will operate at the maximum power point.

3.1 INCREMENTAL CONDUCTANCE ALGORITHM:

This method exploits the assumption of the ratio of change in output conductance is equal to the negative output Conductance Instantaneous conductance.

We have,

$$P = V I \quad (4)$$

Applying the chain rule for the derivative of products yields to

$$\partial P/\partial V = [\partial (VI)]/ \partial V \quad (5)$$

At MPP, as

$$\partial P/\partial V=0 \quad (6)$$

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The above equation could be written in terms of array voltage V and array current I as

$$\partial I/\partial V = - I/V \qquad (7)$$

The MPPT regulates the PWM control signal of the dc – to – dc boost converter until the condition: $(\partial I/\partial V) + (I/V) = 0$ is satisfied. In this method the peak power of the module lies at above 98% of its incremental conductance.

3.2 MATHEMATICAL EXPRESSIONS

FINDING CURRENT & VOLTAGE FROM IRRADIANCE

The voltage and current relationship of the simplified solar cell can be derived from Kirchoff's current law. According to Kirchoff's current law, all currents entering and leaving a node add up to zero.

$$I = I_{Ph} - I_D = I_{Ph} - I_S \cdot \left[\exp\left(\frac{V}{m \cdot V_T}\right) - 1 \right]$$

Where

I_{Ph} is the photocurrent

I_D is Diode current

I_S is Diode reverse saturation current

m is Diode ideal factor

V_T is Thermal voltage (25.7mV at 25°C)

BOOST CONVERTER OUTPUT VOLTAGE

V0 = Vin 1/ 1-D

Assume, Vin = 12

D= Duty cycleD=0.5

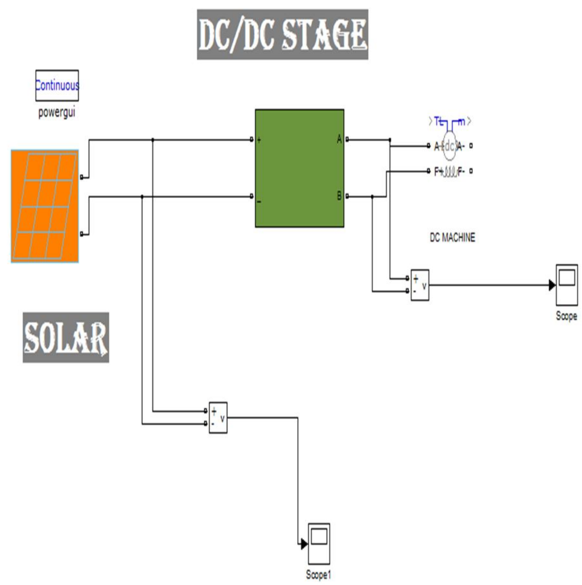
V0 = 12*1/0.5

V0= 12*2

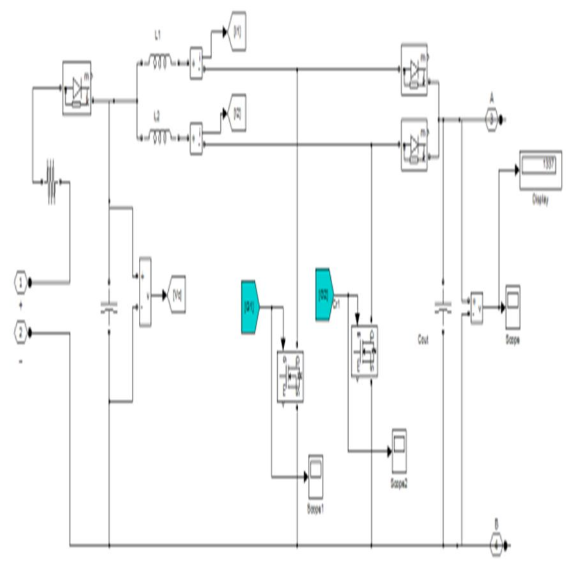
so the output voltage,

V0= 24V

4. SIMULATION CIRCUITS



4.1 CIRCUIT DIAGRAM WITH BOOST CONVERTER



4.2 SIMULATION OUTPUT

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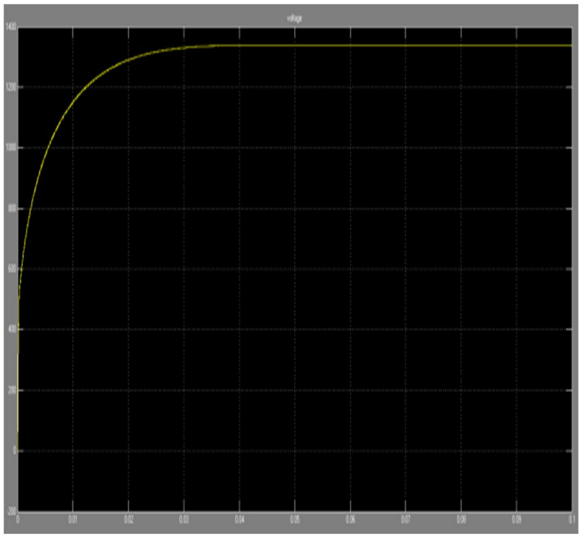

5. CONCLUSIONS

In this project, a constant voltage MPP algorithm was proposed. In the MPP algorithm presented, a switch was connected in series with a pilot array that periodically opens, and the open-circuit voltage was measured. The value of the open-circuit voltage was used as the reference voltage for the PWM modulator. The reference voltage in this scheme was dynamically tracked online, avoiding the need to break the main circuit as done in the conventional constant voltage algorithms. Unlike the conventional algorithm, the proposed version also took into account varying environmental conditions. A 300 W boost converter with a feed forward controller was constructed and interfaced with the solar cell array and the load. The proposed MPP algorithm was verified using a DC motor load. The performance of the interconnected system has been investigated and analyzed. MATLAB/Simulink simulations and experimental analyses were presented to demonstrate the performance of the system. The constant voltage maximum power point (MPP) algorithm presented is a simple (and inexpensive) method to continuously track the MPP of the solar cell array in Fig. 1 as the weather conditions vary.

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