Design and Analysis of Quasi -Z- source Resonant Converter for Hybrid Energy Resources for Rural Electrification

John De Britto C, S.Nagarajan

ABSTRACT--- The paper proposed is the design of complete analysis in quasi Z-source converters which give a largerange of primary side voltage and output side load regulation supports to multi-waypractice. By analyzing buck and boost up operations with an efficient range of output power and here we are using zeta converter for both buck boost operations. It offers controlling of the voltage using the fuzzy logic for modified amalgam power sources by z-origin converters. Amidst inexhaustible power origin, the gale and PV power are frequently used for their sustainability to generate electricity, here too both solar and wind are used to produce renewable energy. The required Maximum Power from Maximum Power Point Tracking(MPPT) attained and analyzed with means of calculating converter's duty period and helps in monitoring required photovoltaic pattern's high energy plot.

The Principle of planned resonant converter is described with Photovoltaic and wind module. These two output levels are combined to give the renewable energy output. 500V dc output is developed from the solar PV module. And with the wind turbine also we can generate of 500V dc output.

Keywords-DC-DCconverter,solarmodule,windmodule, Resonant converter,fuzzy logic, MPPT.

I. INTRODUCTION

Due to the availability of high current power electronic devices, it is mandatory to use several converters in parallel for efficient high-power and low cost applications. Hence these parallel converters can raisethe output voltage in a large range. This proposed system achieved a peakefficiency, whichcomprises the power and control scheme losses. This methodology and its performances are validated and analyzed using simulation results which are obtained in MATLAB/Simulink to establish the entire developed system. This work has a new topology and structure based on the combination of Quasi z-source resonant converters to raise the voltage gain and supply high load currents. This work is preferred for getting the peak energy control derived by the wind generator and PV pattern. The fuzzy logic controller gives improved performance than basic controller. Wind's high energy plot and PV array immediatelyfinds the maximum power with higher accuracy with fuzzy controllers. And these fuzzy inputs are shared with a number of variables with respect to system and limit of connection in every single task fixed.

A load side exhibit handling manipulation process created with control mechanism of every limits. Proposed new module resonant converter has the following features as, Peak to peak ripple current is further reduced by inductors of QZSC, potential benefit of the planned converter is enhanced with increasing in Quasi z-source resonant converters number. The scheduled wind dynamo also PV cell are calculated for deriving peak force of wind with cosmic intensity supply. Various model of DC-DC novice is useful for generating wind and PV systems in achieving the DC potential. It is applied to z-expert converters possess reduction in potential level(buck) and increasing the voltage(boost) capacity of finding potential intensity AC of 440V. Analyzing FLC approach, timbre is significantly curtailed in produce clear potential sine wave pattern of less falsification.

II. DESIGN OF HYBRID ENERGY RESOURCES WITH PV AND WIND MODULE

A.PV module:

PV module uses Photovoltaic array to produce electric power. PV cell is modeled with Diode, Resistor and Current source and the developed output current will be measured by current scope. MPPT boost converter is also used here to achieve the maximum output power and the required output voltage will be obtained and amplified by means of boost converter.

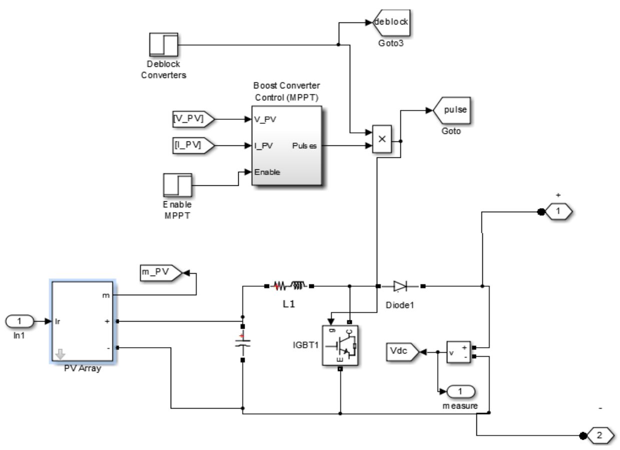

Fig 1.1. Design of PV module

Software design of PV module is completed and it produces 500V DC output.

Revised Manuscript Received on December 22, 2018.

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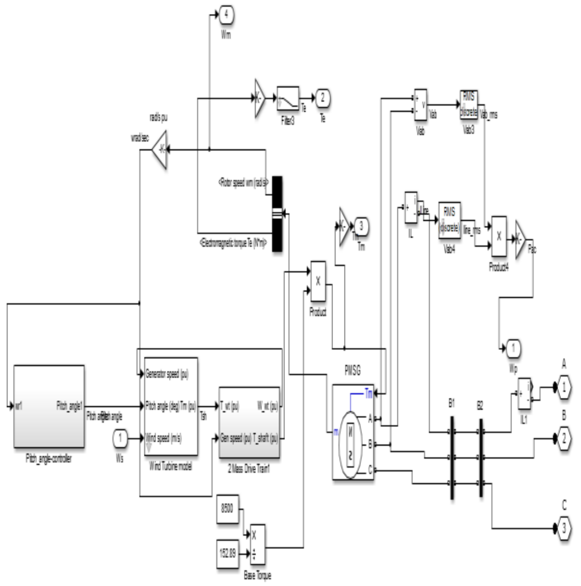

Fig 1.2. Design of Wind turbine module

The proposed model of ultimate energy plot detecting conditions are succeeded by addition of augmental delivery process with intrinsic switch.

Maximal efficiency attained if the case is,

$$\frac{dP}{dV} = 0$$

Where $P = V \times I$

$$\frac{d}{dV}(V \times I) = I + V\left(\frac{dI}{dV}\right) = 0$$

$$\frac{dI}{dV} = \frac{-I}{V}$$

The elemental switch cuts the error $\left(\frac{dI}{dV} + \frac{I}{V}\right)$

controller output = periodic cycle correction.

B.Wind module:

It uses wind turbine module, two mass drive train module, Pitch angle controller and Permanent Magnet Synchronous Generator (PMSG) for power generation. DC-DC transformer is used to change the AC signal to DC power. This uses controlled AC voltage source, MOSFET switch smoothing capacitor and feedback controller for the entire converter process.

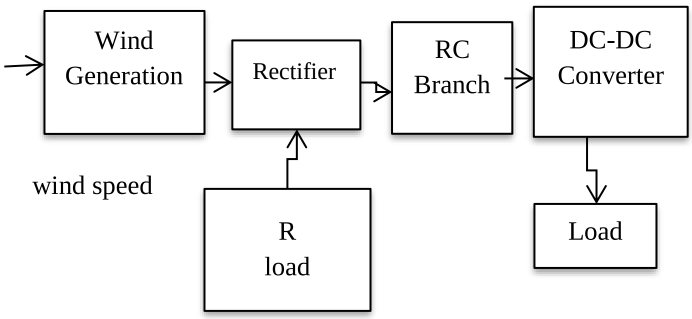

Fig1.3. Block diagram of Wind module

C. DC Battery:

This will be operated when both solar power and wind power are not available.PWM generator generates the pules to the MOSFET switch and duty cycle is also applied to the converter circuit through adder and devider module. Through PWM operation the output voltage can be purely controlled. And the harmonics are significantly reduced.

D.Zeta Converter:

It is one of the frequent fourth order DC-DC converters. It performs both buck and boost operation. Generally this is operated by rising the value of duty cycle or decreasing the value of duty cycle. If the duty cycle ranges from 0 to 0.5 it performs buck operation. If it is varied from 0.5 to 1 then it performs boost operation. Two modes of operation are performed by the zeta converter (i.e) charging mode and discharging mode.

During charging mode, the converter minimizes the output voltage. During discharging mode, the converter increases the output voltage.

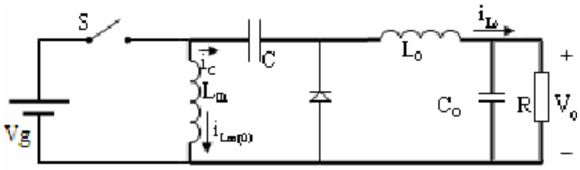

Fig 1.4. Design of zeta converter model.

E.Renewable Energy:

Photovoltaic module and wind module will produce suitable electrical power. Both the outputs are integrated to give renewable energy and it will be used for several power electronics applications such as water pumping, UPS .

F.Inverter Circuit:

The output from the Solar panel is in the form of DC output voltage. This will be increased by means of maximum power point tracking algorithms. The DC output can be converted into a three phase voltages or current by means of this DC-AC inverter circuit. Voltage source controller is used to produce the suitable output. The reactive power compensator circuit is used to deliver the required compensated output to the load.

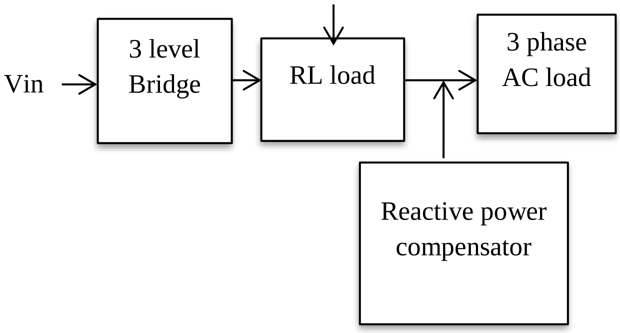

Fig 1.5. Block diagram of Inverter Circuit

Evaluatingthedesign of renewable energy, solar is most frequently used to be continuous which is implementable in a country. Photovoltaic (PV) array's peak point is highly varies so a search

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The planned converter's task period denotion ,varied with help of applying pulse width modulation to the switches.

MPPT algorithm is generally used, because of its comfort of realizationItis measured as a tough one due to its capability to producegreater efficiency at varying conditions. It is also measured to be a currentprocedure.

Algorithm is essential giving to the cosmic cell's voltage-current (V-I) curve along power-voltage (P-V) curve. By analyzing this Parallel resonant converter, Minimum switching losses can be achieved as well as broadly utilized for converter having peak voltage gain will be preferred. Fourth order DC-DC zeta converter is used in battery for the entire buck boost operation.

III. SIMULATION RESULTS

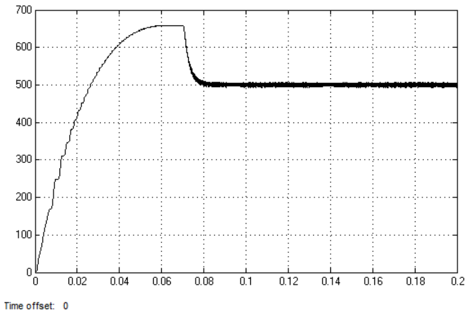

Fig 1.6. Solar PV Output voltage

The developed DC output voltage from the solar panel is 500V.

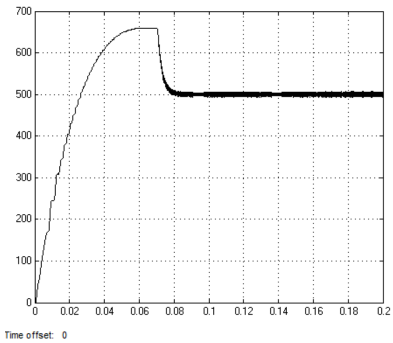

Fig 1.7. Wind model output

The developed wind DC output is 500V.

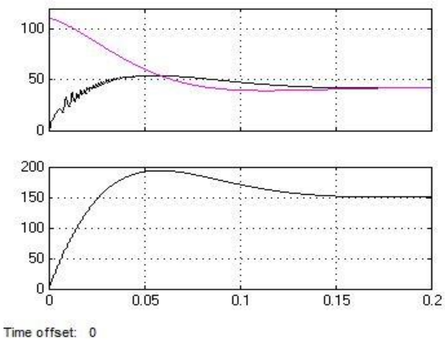

Fig 1.8.Wind turbine drive train model

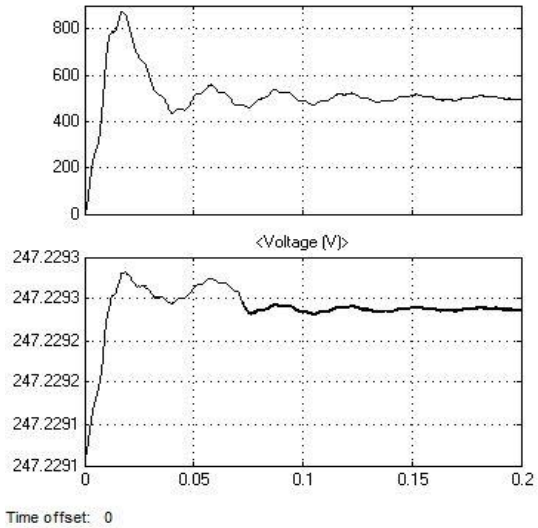

Fig 1.9. Battery output Voltage

The battery develops 500V DC output, and it will be used when both wind and solar power are not available.

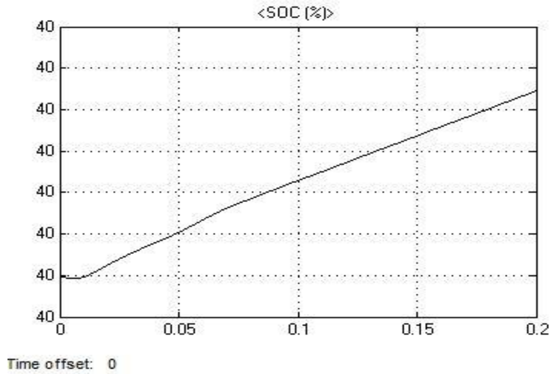

Fig 1.10. Point level(SOC) of the batery

The allegated potential of the processed battery is 40V dc.

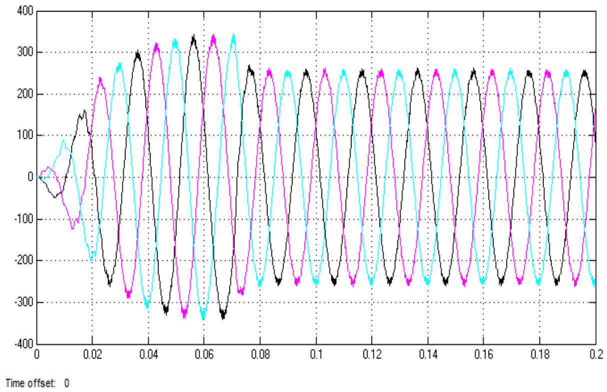

Fig 1.11.Single phase 230V ACInverter output voltagedeveloped from single phase inverter output.

IV. CONCLUSION

The planned model can also produce ripple free output from the source. By using Quasi Z source converter, the primary side of the converter provides both buck and boost operations, which can be obtained with the help of zeta

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converter. The software design of PV module and wind module has been completed which gives an output DC voltage in the range of 500V. Also the output peak to peak ripple current values can be reduced. Losses can also be reduced and the system increases efficiency. The inverter is designed to give a 230V AC supply. And the DC battery also used here for emergency applications. This output can be used to supply 10 hours of electricity in rural areas. Power efficiency schemes are significantly enhanced and harmonics also greatly reduced. Design is owned by the software MATLAB Simulink for modeling the complete planned system.

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