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An Dynamic Voltage Regulator For HVDC System On Low Power DC Line With Series Active Power Filter And Reducing Repulsion To The Transmitting Station

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Abstract

Harmonics in HVDC power systems, which are caused by highly non-linear devices, affect its performance. Therefore, the main concern of power engineers in power system design and operation have been controlling and eliminating such repulsion. In respect of this, HVDC power system repulsion analysis is, therefore, imperative in power system planning, control and operation. It is worthy of note that, different alternatives of filter design should be considered before making final decision on filter Configuration. In this paper the reduction of harmonics in the HVDC power transmission system by implementing the active power filter. Also the power factor is increased drastically by reducing the current harmonics in the load side. The solar PV output can be presented and analyzed with help of boost converter in order to proof that the solar output voltage can be increased by the boost converter. The series active power filter appears to be a viable solution for eliminating repulsion currents and current transient condition. Shunt active power filter compensates current by injecting equal voltage compensation is created by nonlinear loads.

Keywords: *Voltage Regulator, HVDC System, Low Power DC Line*

INTRODUCTION

In recent years renewable energy growth is shown as tremendous growth. These systems employ with micro sources like PV, fuel cells etc. In order to increase more amount of from the solar panel the more number of series connection can be increased. The numbers of solar cells are interconnected and make into a single panel and many panels are interconnected and make it into a single array [1]. The output voltage of array is increased on output side. In order to overcome such adverse effects this micro source energy is utilized by the high step up converter to produce high voltage and satisfy the demands. Low level voltage from the PV, fuel cells is connected to Kilo watt evel using step up dc-dc converter and inverter circuits [2]. The active clambing can be used to reduce voltage spikes and switching losses in dc to dc converter. But the cost of resonant converter is high as compare with other converter [3]. By using transformer turns ratio changing the efficiency of the converter is increased. Impacts of SiC (silicon carbide) MOSFETS on converter, switching and conduction losses are reduced even though fast switching is done [4]. Si diodes have ideal, but sill SiC devices processes large amount of ringing current at turn OFF relatively to other devices [5]. Package of external diode and the diode itself have more parasitic capacitances that are added to the devices parasitic aggravating the ringing [6].

LITERATURE REVIEW

"More than ENVIRO-friendly: renewable energy is also good for the bottom line" With the increasing integration of renewable energy generation into high power grids, transmission at the DC level is becoming increasingly more useful than AC transmission. This paper presents a new high voltage gain resonant switched-capacitor (RSC) DC/DC converter for high power offshore wind energy systems [7].

The proposed DC/DC converter is described by the full changing advances to accomplish insignificant exchanging misfortunes and greatest framework efficiency. Therefore, a higher exchanging recurrence is possible to achieve a higher influence density. The twofold stage yield voltage of the proposed converter works at multiple times as high as the information voltage with a little gadget check [8].

The output capacitors are charged and discharged continuously by a 180º phase shift with respect to each other to eliminate the output voltage ripples with the low capacitance requirements. The proposed arrangement particular and course designs demonstrate the characteristic preferred standpoint of being promptly appropriate to multi-organize control exchanging converters. The created topology has been executed on a 5-kW model converter to test its attainability [9].

“Dynamic modeling and operation strategy for a microgrid with wind and photovoltaic resources” ANY applications powered by batteries call for high performance, high step-up dc–dc converters. For instance, for a high force release (HID) light weight utilized in car headlamps in which the start-up voltage is up to 400 V, the dc– dc converter needs to support the 12 V of the battery voltage up to 100 V amid enduring state activity [10]

PROPOSED SERIES ACTIVE POWER FILTER FOR PV

A hybrid system comprise of Photovoltaic (PV), Battery, Ultra capacitor (UC), Fuel Cell (FC) to meet isolated DC load demand. To increase the reliability of the system source FC has been chosen to keep the battery fully charged. The battery sources are connected to DC bus by DC-DC converters. In this work, FC is chosen to work for a limited period. This will avoid the over sizing of the FC and limit the operational cost of the system. Fig. 1 shows the block diagram of proposed active power filter for PV applications.

The various advantages of the proposed system

This circuit is having Dual Ultra Capacitor (DUC). The proposed DC-DC Voltage Source Converter (VSC) having fewer harmonic. The Load sharing is among all the energy sources in energy management strategy. The Charging-discharging cycle of battery is allowed for all the conditions. Battery is allowed to discharge up to a certain limit and then it gets charged. Less Switching Losses.

BLOCK DIAGRAM OF PROPOSED SYSTEM

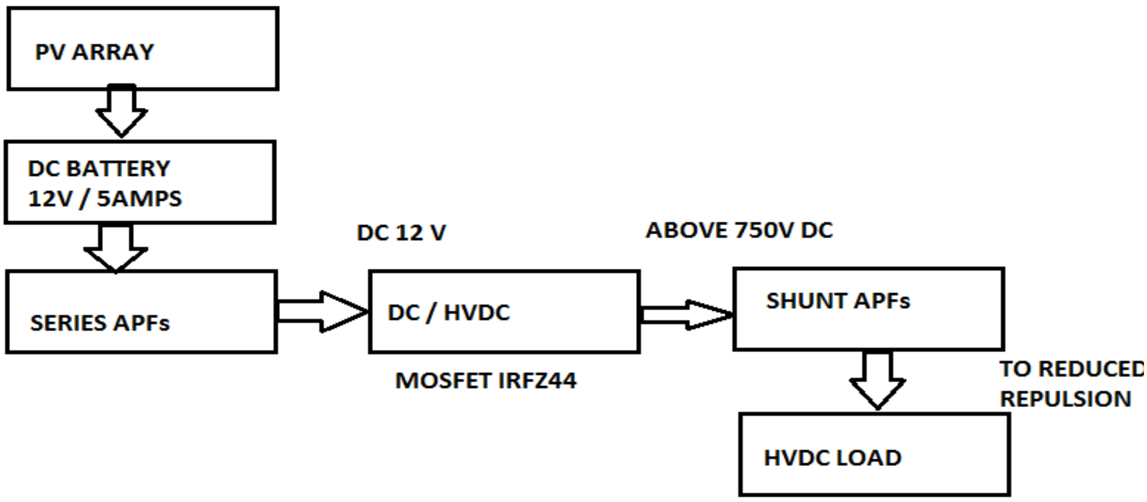

Figure 1: *Proposed Active power Filter Block Diagram*

MODELING OF PROPOSED SYSTEM

HIGH-VOLTAGE DIRECT CURRENT TRANSMISSION

The HVDC transmission is advantageous for power delivery over long distances and asynchronous interconnections by using overhead lines or underground cables. One of the most important aspects of HVDC systems is its fast and stable controllability. It is a settled innovation and since its first business presentation in 1954 in Sweden in excess of 50 ventures have been acknowledged. As of not long ago, the exemplary HVDC transmission dependent on thyristors was utilized for power transformation from air conditioning to dc and the other way around. Appearance of Voltage Source Converter (VSC) utilizes further developed semiconductor innovation rather than thyristors. The VSC-based HVDC establishments has a few focal points contrasted with great HVDC transmission, for example, free control of dynamic and receptive power and separate power frameworks interconnection.

HVDC CONVERTER ARRANGEMENTS

Monopolar HVDC system is presented In this configuration, two converters are used which are separated by a single pole line and a positive or a negative dc voltage is used.

RESULTS AND DISCUSSIONS

MATLAB Model of proposed system

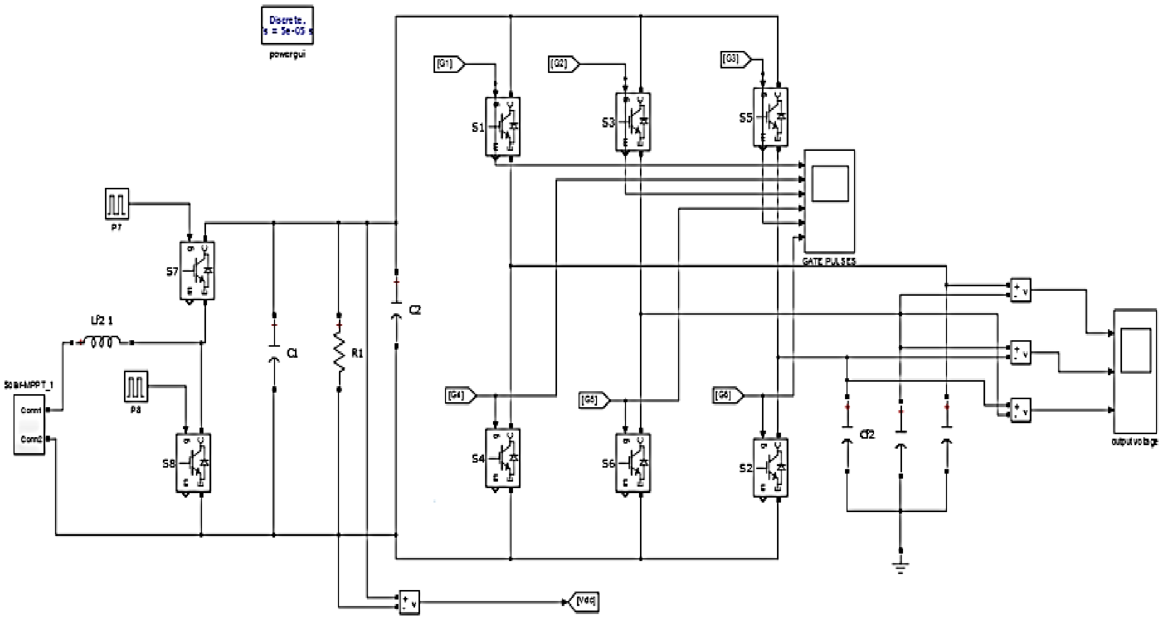

Figure 2: *Developed simulink model of proposed system*

The development of active power filter for PV application is modeled in the MATLAB environment. It consists of source module that is PV array for DC voltage generation. The output voltage is increased by DC to DC boost converter and the high voltage dc in inverted and fed to the load via high DC transmission system. The harmonic of proposed system is eliminated by active power filter designed by the MOSFET switches. The control strategies of active power filter is generated by the PWM signal generation in matlab. Fig. 2 shows the modeling of PV cell with boost converter and inverter.

SIMULATION RESULTS

The proposed system is modeled in the MATLAB simulink environment and analyzed the result through different scope of the model. The solar cell with MPPT system is consists of 12V DC power generation with PV module of MATLAB. The output is given the DC to DC converter to improve the required dc voltage. The incremental conductance algorithm is implemented in the proposed system and ensured the maximum power point obtained in the output terminal of the solar panel.

Solar Cell with MPPT

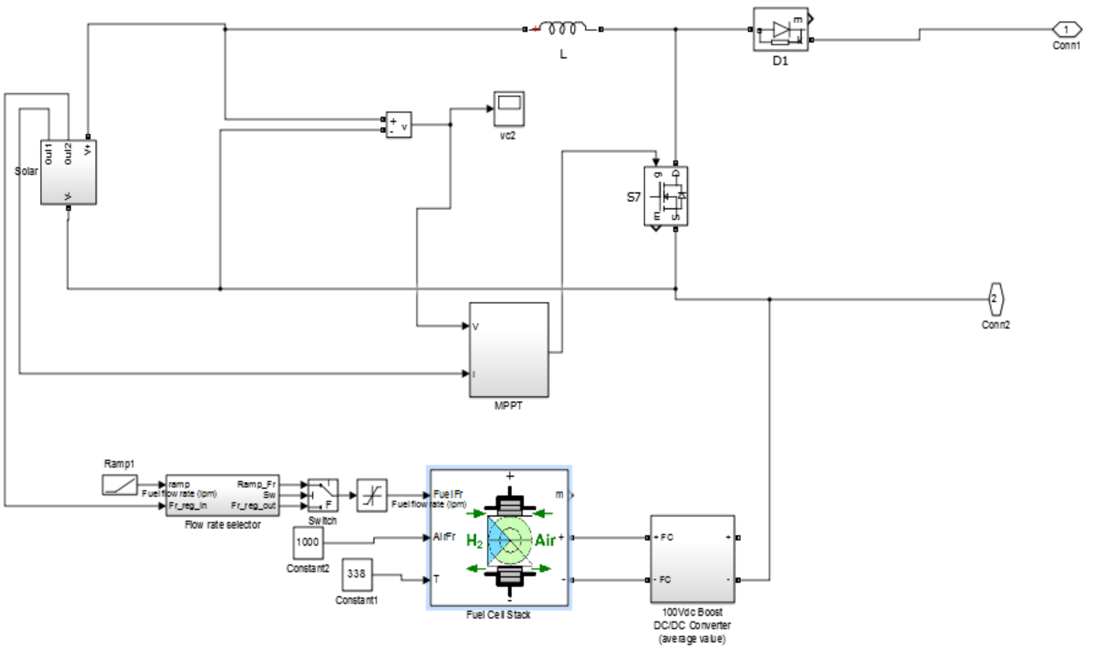

Figure 3: *Solar Cell with MPPT*

Fig. 3 presents the simulation results of Solar PV array consists of three modules in series for three set of different shading patterns. The performance of the Genetic algorithm is validated graphically by comparing its output (marked in green color) with that of the fuzzy logic with hill climbing method (marked in red color). In all the cases, Genetic algorithm gives the optimum power (global peak) which is matched with the result of fuzzy logic with hill climbing method. Fig. 4 shows the output PV voltage before implementing the MPPT techniques.

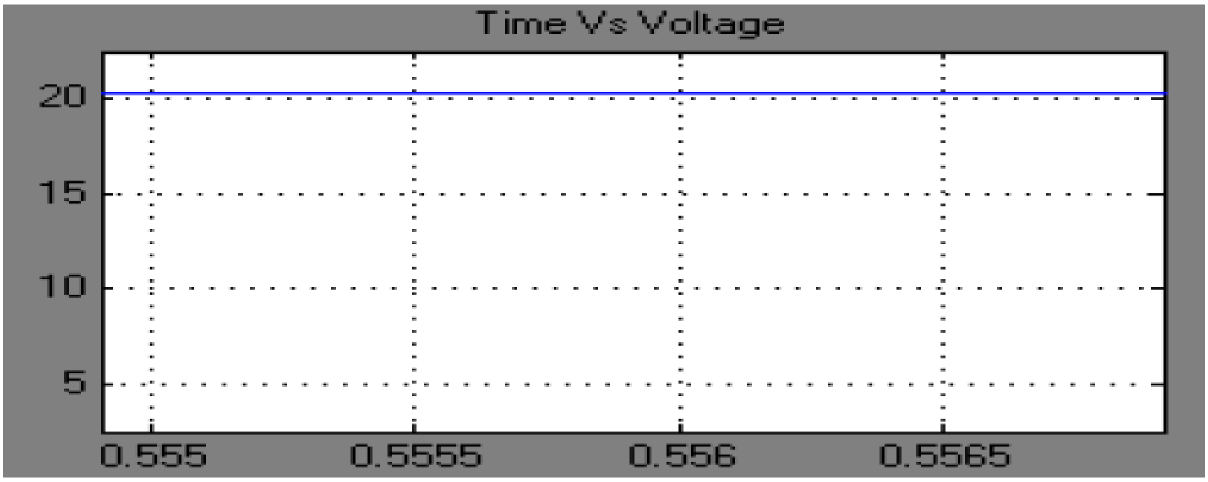

Figure 4: *Generated DC voltage from PV Panel*

Proportional Integral Controller logic
The control signals of PV and shunt active power filter is obtained by the Proportional integral controller. The difference of the input signals and generated as a error signal. Based on the error signal the pulse width modulating signals are generated and fired the MOSFET switches which are presented on the converter and inverter circuit of shunt active power filter. Fig.

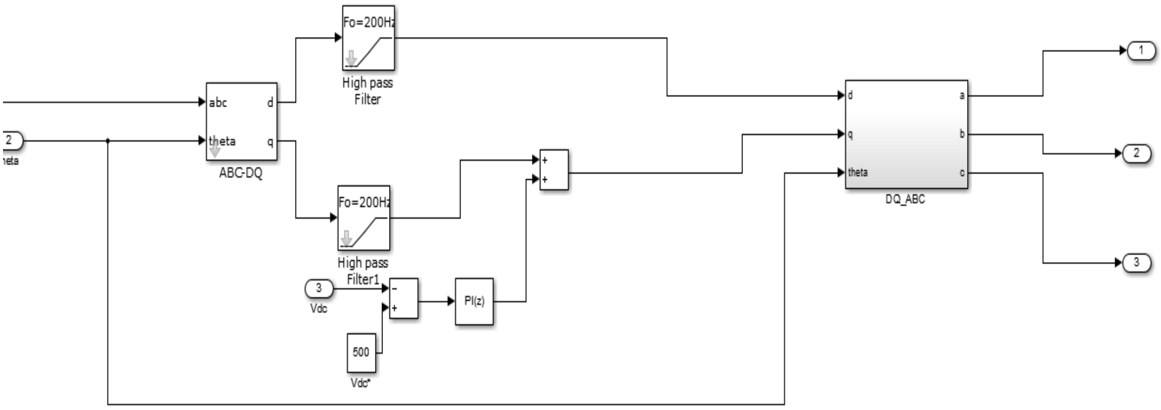

Figure 5: *Proportional Integral controller for proposed system*

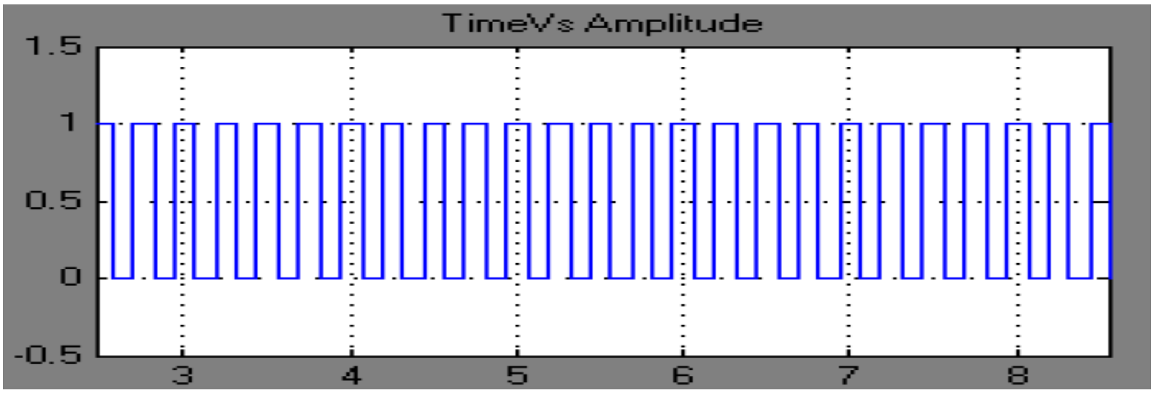

Figure 6: *Generated pulse signal for Active power Filter*

Fig. 6 shows the generated pulse width modulation signal for proposed system. The generated signal fired the MOSFET switches and getting the improved voltage which is shown in the figure 7. The output voltage is obtained around 50 V DC after implementing the boost converter operation.

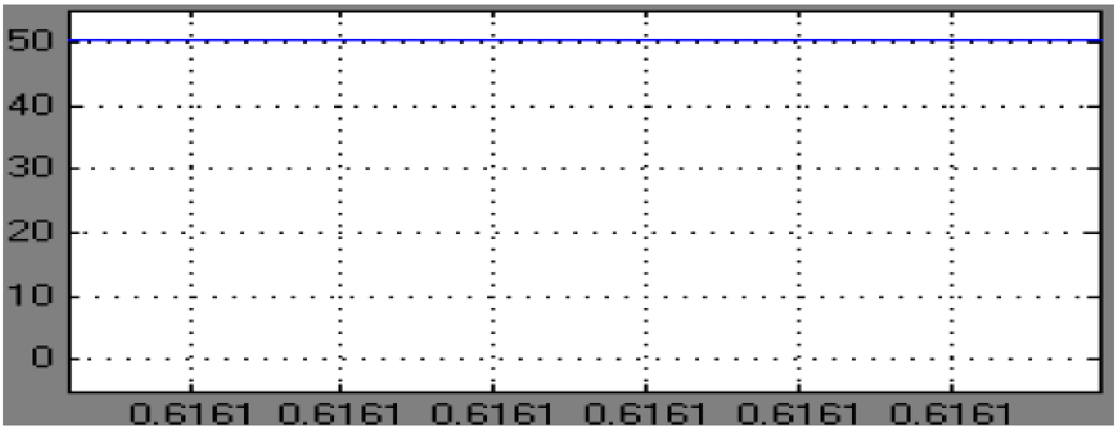

Figure 7: *DC output voltage at Boost Converter*

CONCLUSION

In this paper a high advance up disconnected converter with two information control sources utilizing voltage-braced and delicate exchanging strategies. In the independent express, the properties of current sharing and delicate exchanging ensure that both conduction and exchanging misfortunes can be diminished for high proficient change. In the unified power supply express, the greatest effectiveness of the proposed converter could be higher than 95%, on the grounds that the conduction misfortune can be successfully diminished by topological plan of arrangement association of two info circuits. In the charge and release express, the change effectiveness somewhat diminishes in light of the fact that higher current stacking on switches is brought about by inverse inductor flows. Luckily, the capacity of bidirectional power stream can be accomplished without an assistant power converter.

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