LMS BASED MODEL PREDICTIVE CONTROL FOR HIGH GAIN BOOST CONVERTER OF PHOTOVOLTAIC POWER SYSTEM

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Abstract— A Model Predictive Control (MPC) for single-phase network connected inverter for PV Power system. This System single-phase inverter is a five-switch inverter. The inverter is controlled to insert sinusoidal current into the network. MPC provides control of the amplitude and frequency of the injected current. Five-switch inverter consists of an h-bridge inverter and one switch is added. The added switch enables decrease the switching losses and voltage stresses across the h-bridge inverter switches. The system has some inherent features such as high gain, reduced switch losses and reduced switches voltage stresses.

Index Terms-- ***Model Predictive Control; H-Bridge Inverter ; PV Array; Ideal Switch.***

I. INTRODUCTION

Now a day, there is a demand of power supply. To get together the improved demand, the power generation from renewables increases day by day. Most of renewable energy in the form of dc. To mix this generated power from renewables to grid, it requires a low-priced, robust, efficient converter i.e. H-Bridge Inverter And Ideal Switch.

In Recently renewable energy sources have gained much thought due to the energy System all over the world. Photovoltaic (PV) structure is one of the main renewable energy sources these days. A photovoltaic system converts sunlight into electricity. Some applications require electronic converters to process the power from the photovoltaic. These converters may be used to adjust the voltage and current at the load or to control the power flow in grid linked systems and mainly to track the utmost power point (MPP) of the device. A high voltage gain boosting is required to boost the low generated voltage from the PV module into the load power which is between 100V-240V. High step-up DC-DC converter is a which can boost a low voltage to high voltage.

The Some parameters such because the inductors corresponding sequence argument (CSA), usual Boost converters cannot provide a high voltage gain. The really thin turn-off time will bring large peak current and significant transmission and switching losses. Lots of researches have been done to provide a high step-up by means of no an very high duty ratio[1]-[5]. Transformer less converters have been extensive calculated to achieve high efficiency. The transformer less converters can be generate as the coupled inductor type and non-coupled inductor. A number of joined inductor based high step-up converters has been developed, by increasing the turns relation of the coupled inductor similar to that in isolated converters. The non-coupled inductor type can achieve[6]-[8] high voltage gain with minimized magnet elements.

H-bridge inverter is a buck inverter output voltage is lesser than input voltage. It has a simple circuit and low elements counts, leading to lower cost and high effectiveness. Such as robust performance and high reliability. Depending on the number of stage between input and output, inverters could be classified as single stage or two phase inverters. Depending on the input dc voltage with compare to output ac voltage, inverters can be buck mode, boost mode, or buck-boost mode. Single-Stage inverter is consists of only one stage. The meaning of this stage is to 1) maximum power from PV array, 2) boost low dc output voltage to a high ac voltage and 3) inject a sinusoidal with a low THD in to the grid . Model Predictive Control (MPC) is extremely quick, correct controller and its design is easy .

The major point of the MPC is to create a mold for the controlled system, for forecast of the controlled variable and collection of optimum operation according to the specified cost purpose. Cost function determines the required control criteria..The proposed inversion stage is controlled via MPC control. This system has some inbuilt features such as high boosting ration, reduces switches stresses, simple control, lower switching losses and improved efficiency .

II.PRINCIPLE AND OPERATION OF SIBC

A novel Model Predictive Control (MPC) for a two-stage grid photovoltaic application. Figure 1 is a depiction of the proposed system. The planned scheme consists of a high gain boost converter to boost the low dc voltage of the PV array and highest control from the PV collection. The second step be the inversion stage, which consist of H-bridge inverter with one switch additional. The meaning of the added switch is to enable the reduce of the switching frequency of the H-bridge to about zero.The proposed

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inversion stage is controlled by MPC control. The proposed system has some features such while high boosting ratio, reduces switches stresses, simple control, low switching dead and get better competence

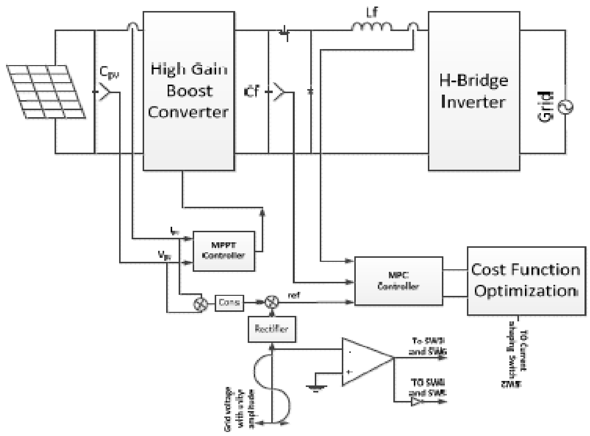

Fig.1 proposed system

The projected system consists of SIBC cascade by means of current shaping (CS)-folded run H-bridge. The SIBC has the benefit of high-voltage add as the conservative DC–DC boost converter loop is replace with a switch inductor twist. The switch inductor consists of two coil and three diodes.This agreement enable the two coils to be exciting in equivalent throughout the on-state and discharge in sequence connections through the off-state.

Operation:

The essential SIBC Circuit figure revealed fig 2(a).the SIBC topology and its prepared three mode these are

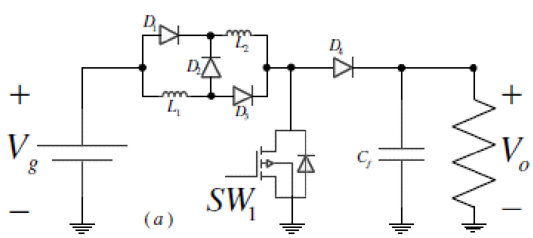

Fig.2(a)

Mode 1:

while switch SW1 is ON, this cause diodes D1 and D3 to be turned ON and diodes D2 and D4 to be curved OFF. so the two twigs of inductors are charging in parallel. Figure 2 (b) show the planned converter circuit off mode 1.

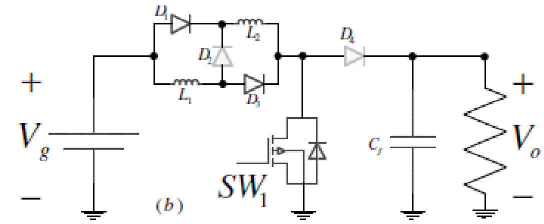

Fig.2(b)

Mode 2:

when switch SW1 is OFF, this reason diodesD1 and D3 to be turned OFF and diodes D2 and D4 to be turned ON and so the two twigs of inductors discharge in series. Figure 2 (c)

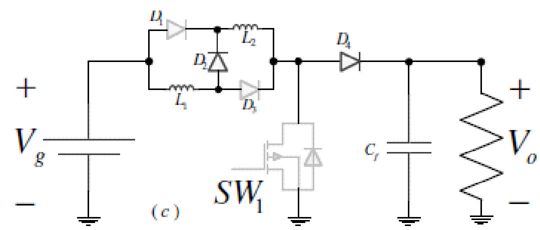

Fig.2(c)

III. MODEL PREDICTIVE CONTROL OF THE PROPOSED INVERTER

The Model predictive control of the projected inverter consists of four switches. and one switch operate on high switching and the relax operates at basic frequency. Switch sw2 controlled to insert a sinusoidal present into the network among unity power factor. The proposed inverter has two modes of process depends on the state of switch sw2. First mode1 when switch sw2 is on and the second mode take place when sw2 is off. process modes of the future inverter. The proposed The model predictive control of the proposed converter as shown fig .3(a)

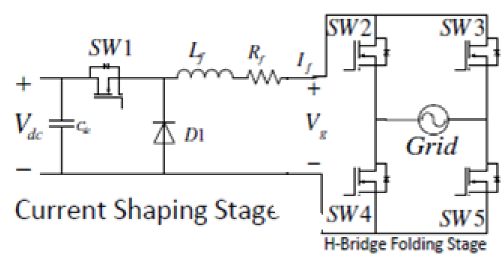

Fig.3(a)

Mode1

In mode Sw2, SW3 and SW4 are on D, SW5 and SW5 are off . The model 1 projecting control of the future converter as shown fig .3(b)

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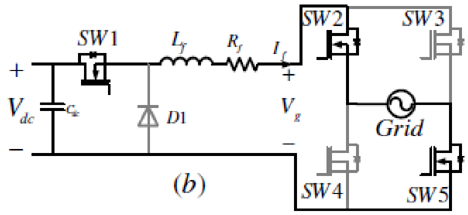

Fig.3(b)

Mode 2:

In this mode D, SW5 and SW5 are on Sw2, SW3 and SW4 are off. The model 2 predictive control of the proposed converter as shown fig .3(c)

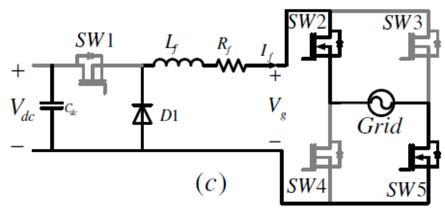

Fig.3(c)

The MPC is the price function as it determine the necessary control function. In the proposed system the necessary control function is to control the amplitude and frequency of the current inject into the grid. For the necessary control criteria for the proposed system the price

The sort inductance, sample instance, filter leak resistance, rectified network voltage, input capacitor voltage, current inductor current, predict inductor current when the switch is turned on, predicted inductor current when the button is turned off, cost function when switch is on, price function when switch is off and reference current generated by the MPPT control correspondingly. Generation of the reference current depends on the MPPT algorithm operation. PV output voltage and current are measured via MPPT control technique then MPPT algorithm make pulse for the elevated increase improve converter and the reference current for the MPC algorithm of the proposed control technique is figured out in Figure 4. rectify network voltage, filter capacitor voltage, inductor current and orientation current are measured the predicted inductor current in equally mode1 and mode 2. price functions in mode 1 and mode 2 are intended then compare jointly. The state of the switch depends on the price function. If is lower than Go, then the switch is rotten, else it's twisted on top of.

IV. Implementation

PSIM software has been new for planned system implementation. Four photovoltaic modules of BP 485 with rated values of 17.8V/4.9A 85W has been used. Grid voltage and grid frequency are 220V and 50Hz, respectively. To validate MPPT control operation a step change has been done at 1.5 Sec. At 1.5 Sec four PV modules has been linked instead of only two. As shown in Figure 5, PV output power changed from 170 W to 340 W. Switch SW pulses and inductor existing is depict into Figure 4, the converter operates in CCM and the ripple of the inductor current can be controlled by inductor value or switching frequency. Model predictive control has a very fast response and reaches to steady state at a very small time.

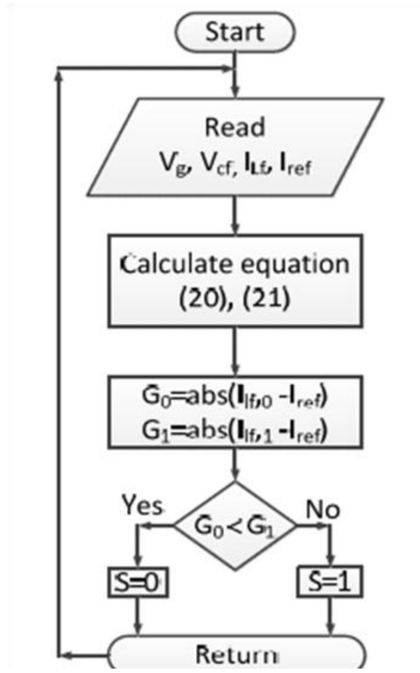

Fig.4

IV . SIMULATION MODEL AND RESULTS

A simulation plan MPC controller in high increase boost converter using is implemented in MATLAB SIMULINK with the help of PV energy, boost converter, inverter, as shown in figure 5.

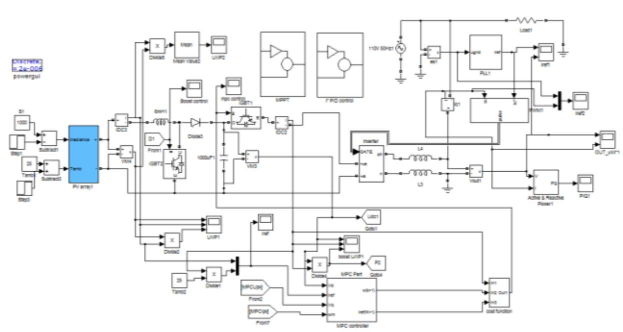

Fig.5 simlink design

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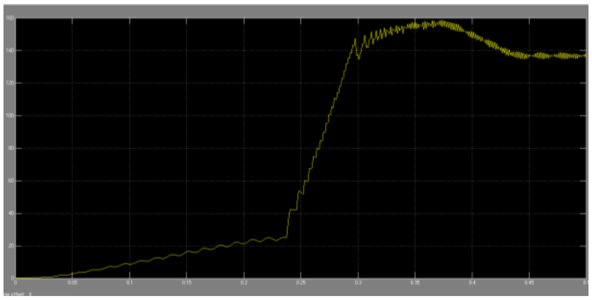
The pv plate voltage waveform (voltage vs time) is fig 6
Pv plate output power wave form as shown below



High increase boost converter duty cycle simlink plan shown below fig.7

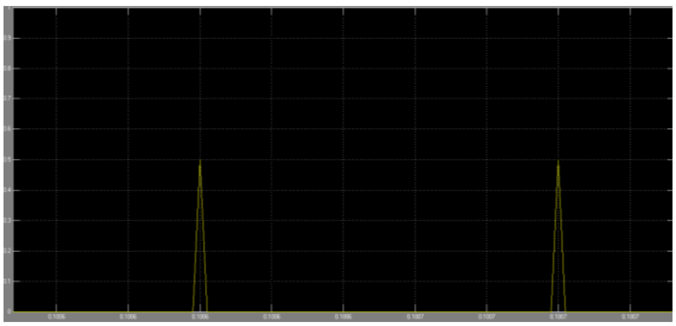


Fig.8

The gird voltage &gird current as shown below fig.9

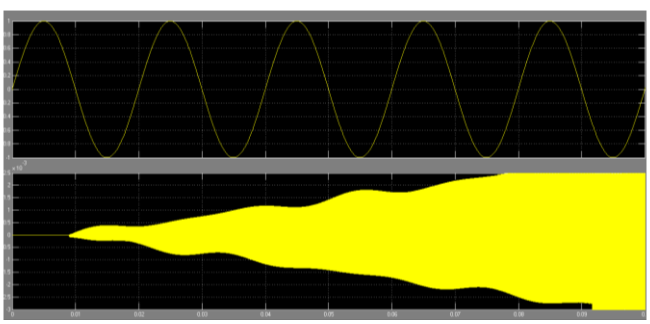


Fig.9

Refrance voltage&inductor current as shown below fig.10

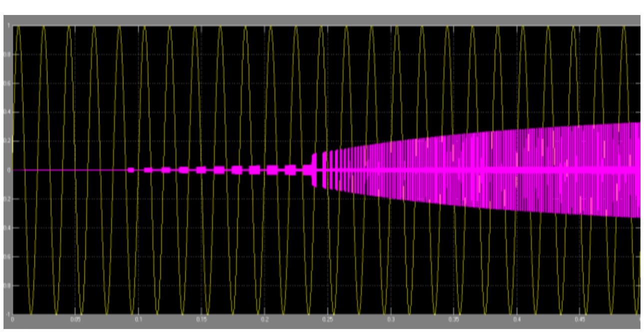


Fig.10

V. CONCLUSION

A novel power condition structure for PV array appliance was proposed. The proposed scheme consists of high gain switch inductor boost converter and five switch current source inverter(CSI).Model predictive control(MPC) was proposed to control the current injected into the grid. The proposed control has a extremely quick respond and reaches to steady state at a extremely little time.

VI. REFERENCES

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