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Three-Phasedual-Buck Inverter with Unified Pulsewidth Modulation

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***Abstract* - For the fast development of clean energy power generation requires the inversion system .In inversion system high reliability is the main target pursuing ,but some problem effect the reliability of the system. such as the shoot through and the failure of reverse recovery. the proposed inverter does not need dead time and thus its avoid the shoot through problem of VSIs. Topology allow to use power MOSFET instead of IGBT it has benefits of lower switching loss so it can be designed at higher switching frequency to reduced current ripple and size of passive components .which greatly leads system reliability. various PWM technique is used to reduced THD contain .the whole system is simulated in MATLAB software.**

Keywords – Dual-Buck Inverter, Unified PWM , VSI

I. INTRODUCTION

The fast development of the clean energy power generation requires the inversion system, especially the inverters, to be more reliable In an inversion system, high reliability is one of the main targets pursuing. Some problems will threaten the reliability of the system, such as the shoot through issue and the failure of reverse recovery. The dual buck inverters can solve the above problems without adding dead time. A new topology of dual buck inverter with series connected diodes. The system retains the advantage of no reverse recovery of body diode. Shoot through problem of the power devices is a major threaten to the reliability.

A traditional method to solve the shoot through issue is by setting dead time. However, the dead time will cause a distortion of the output current. Also, during the dead time, the current may flow through the body diode of the switch which can cause the failure of the reverse recovery. to solved this problem By combining two unidirectional buck circuits, the dual buck inverters will not suffer threaten of shoot through problem and the freewheeling current will flow through the independent diodes which can solve the reverse recovery problem of the MOSFET's body diodes

The widely used three phase VSI faces various problem

[1] shoot –through problem
[2] reverse recovery problem, which effect the reliability of inversion system.

- A traditional method to solve the shoot through issue is by setting dead time.
- Dead time cause distortion of the output current and due to dead time the current may flow through the body diode of the switch which can cause the failure of reverse recovery.
- To solved the above problem the dual buck topologies are proposed by combining two Uni directional buck circuit.

II. PROPOSED TOPOLOGY

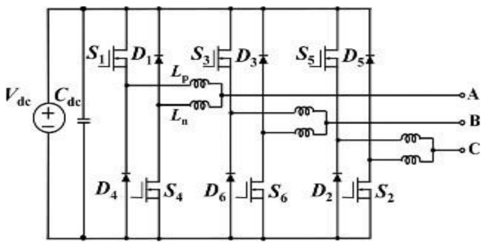

Fig.1 Dual –buck VSI with MOSFETs

Mostly (VSI) has two active switches in one phase leg that requires dead time which Reduced equivalent pulse width modulation voltage and due to this less energy transfer.

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III. PROBLEM DEFINATION

- The rush of current that occures while both devices are on is called shoot –through Problem.
- Shoot-trough is occures due to overlapping opertation so it is also called as cross conduction
- It create due to in proper phase delay given to the switching device
- Too short dead time can cause shoot through problem
- We can not measure the shoot through time because its only for nano second

EEFECT OF SHOOT –THROUGH:

- Reduced efficiency
- Higher MOSFET temperature
- EMI
- Deregulation in output waveform

❖ Traditional Dual Buck Inverter :

- ➢ Traditional VSI has two active switches in one phase leg so dead time needed,which creat shoot trough problem.
- ➢ Dual buck is combination of two unidirectional buck circuit
- ➢ It is not suffer from shoot through problem because this inverter does not need dead time.
- ➢ And freewheeling current will flow through the independent diode which can solved the reverse recovery problem of MOSFET body diode.
- ➢ The MOSFET and diode can be selected independently. with small on -state resistance and diode with smaller forward voltages

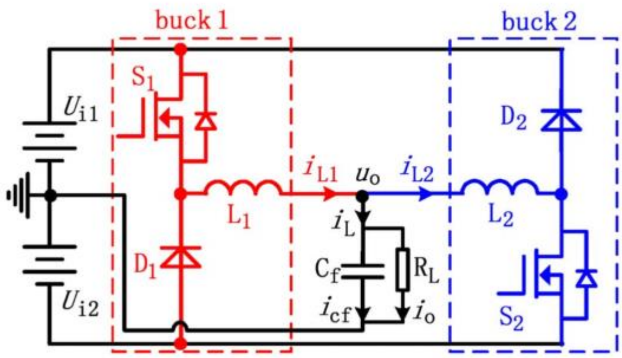

Fig.2 Dual –buck half bridge inverter

III. DUAL BUCK- INVERTER

Dual buck inverter Value of devices:

Resistore:10ohm
Inductor:1.25mH
Frequence:50Hz

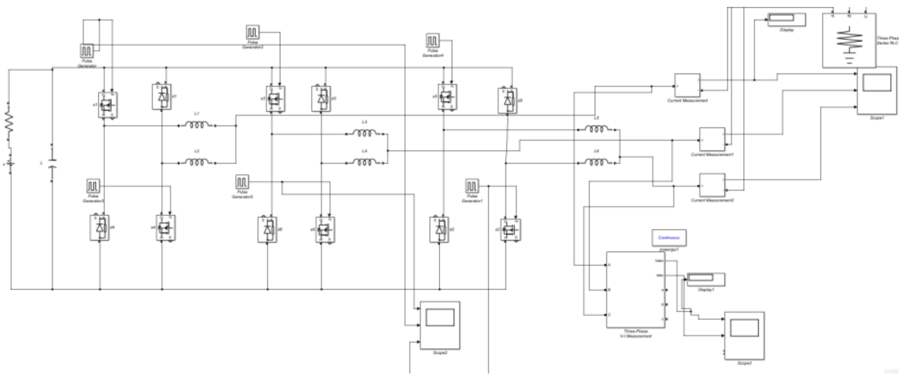

Fig 3. Dual –Buck Inverter

Simulation Results :

Fig.4 current waveform of dual buck inverter

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THD analysis:

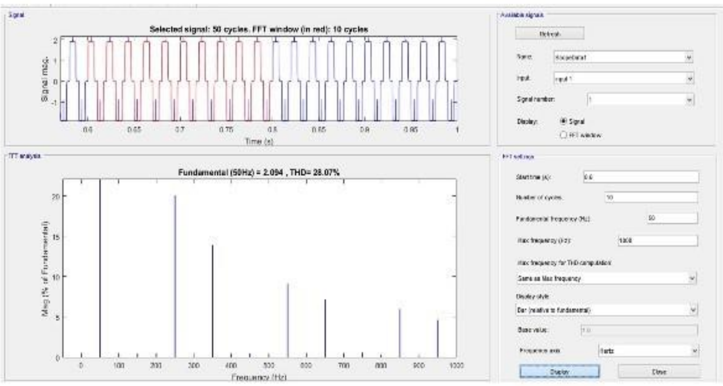


FIG.5 THD Analysis Of Dual Buck Inverter

PWM Analysis (SPWM) :

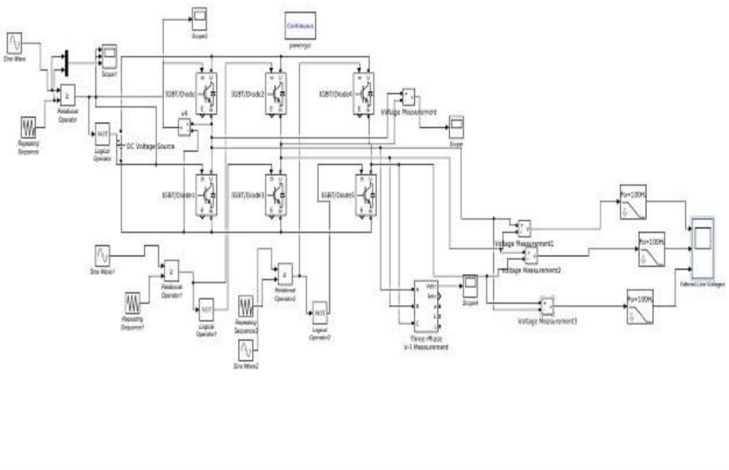
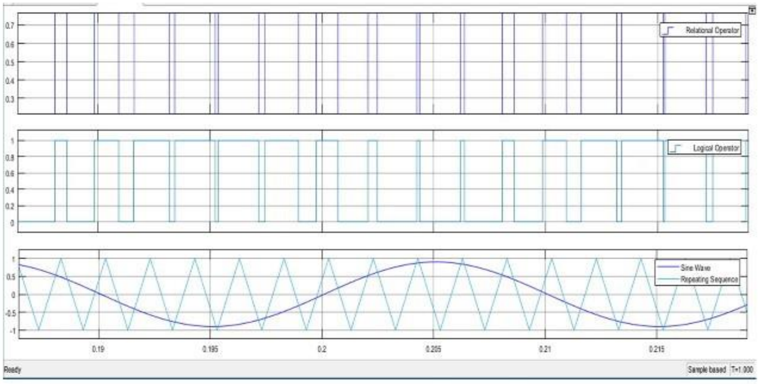


Fig 6. Spwm Matlab Simulation control strategy of SPWM



Line to line voltages(filtered voltages)

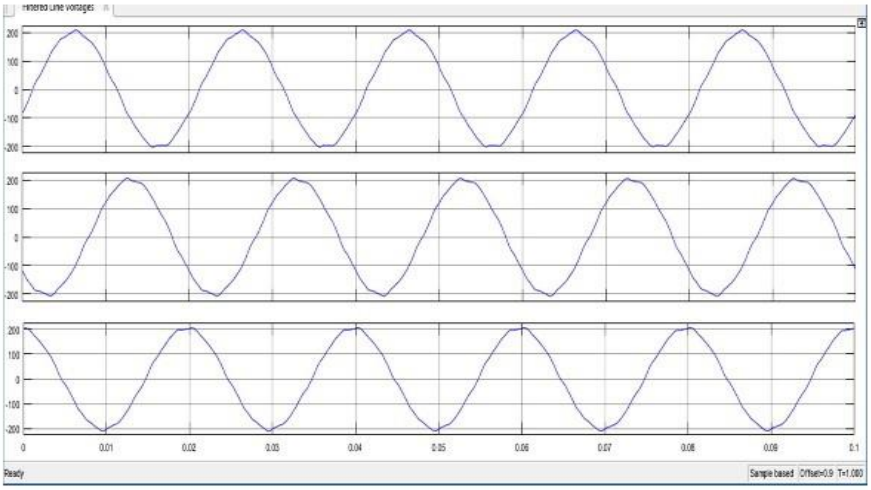


FIG.6 line to line voltages

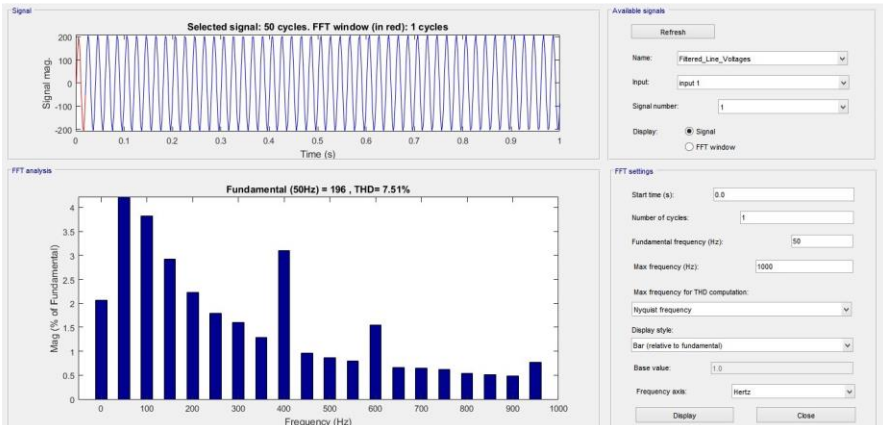


Fig 7. Thd Analysis Of Spwm

SVPWM :

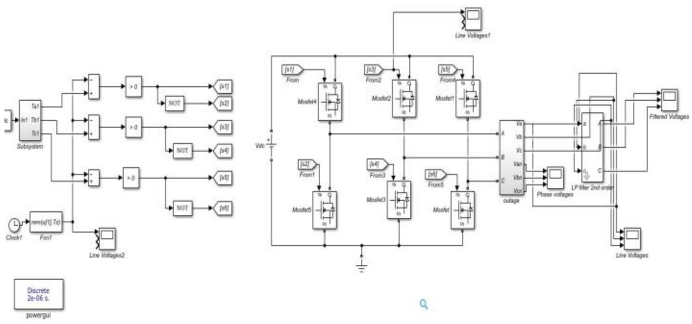


Fig.8. Svpwm Matlab Simulation

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Line Voltages :

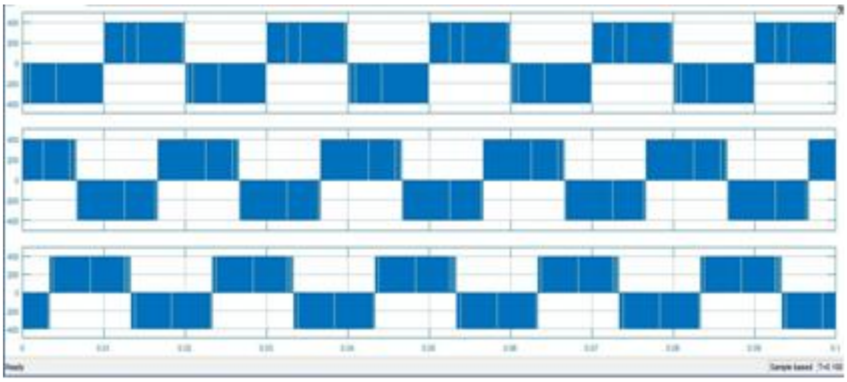

Fig.8. Line voltage of SVPWM

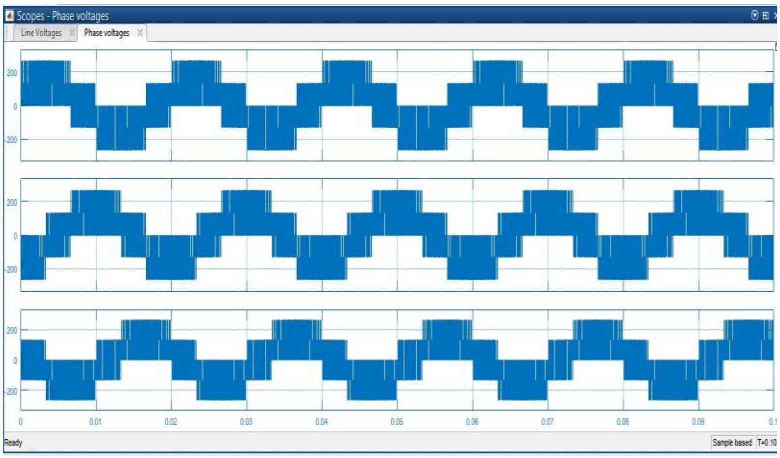

Fig.9. Phase voltage of SVPWM

THD Analysis :

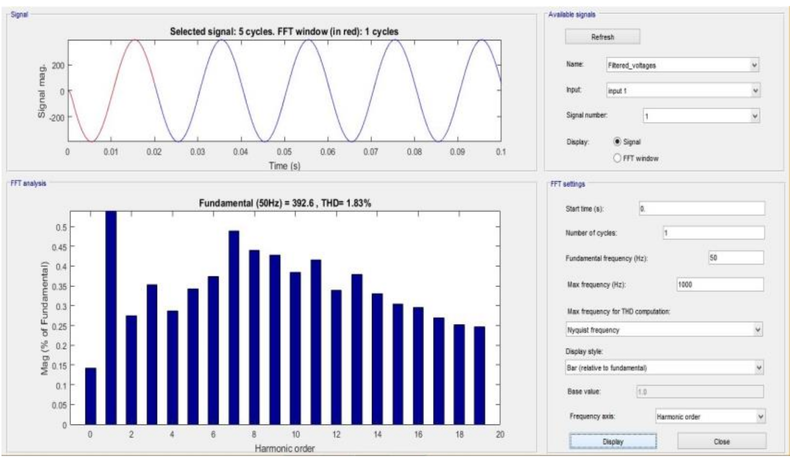

Fig.10. THD Analysis of SVPWM

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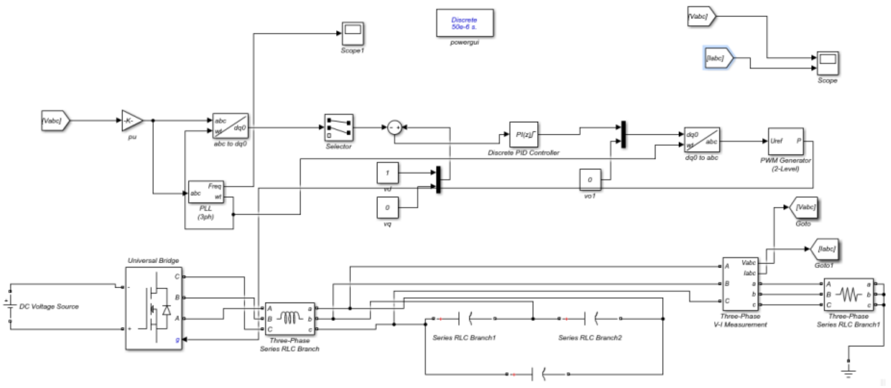
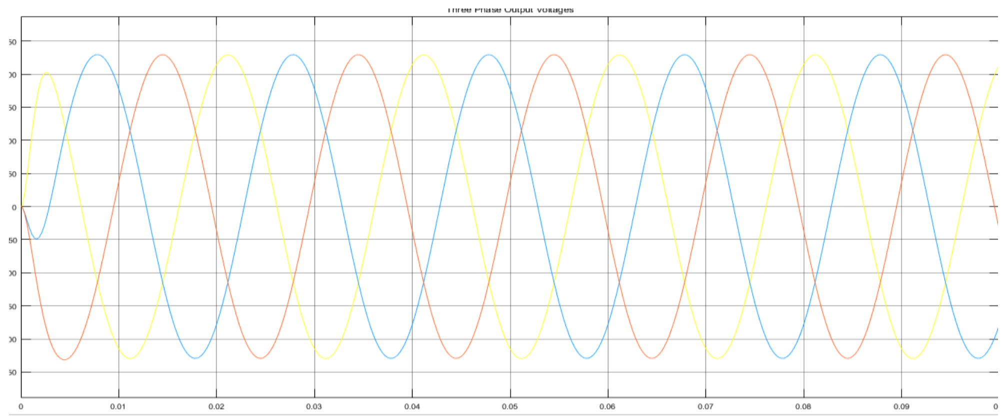
Control strategy:



THREE-PHASE OUTPUT VOLTAGE WAVEFORM:



IV. CONCLUSIONS

From theoretical and experimental result it is obtained that it has high conservation efficiency and no reverse recovery of body diode. here switch is worked at power frequency so the impact of dead time is negligible. thus, impact of shoot –trough problem is ignored. here advantages of using MOSFET as active switches its improved reliability of system.

In ordered to reduced THD contain SPWM and SVPWM control strategy is used which reduced THD contain from 7.51% to 1.83%.

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