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Study of A single phase switched series/parallel cascaded Multi Level Inverter

(SSPS)

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Abstract—This paper represents a single phase multi-level inverter consisting of an H-bridge and dc sources which can be switched series/parallel, So this topology is referred as switched series parallel (SSPS).The SSPS provides a dc voltage with the shape of a staircase approximate to the rectified shape of a sinusoidal wave without PWM to the bridge inverter which can alternate the polarity to produce an AC voltage. The output result has been shown in PSIM(9.1.1)version.

Keywords— Multi level inverter, H-bridge inverter, SSPS, Symmetrical, level generation and polarity generation,

I. INTRODUCTION

Multilevel inverters have created a new wave of interest in industry and research. While the classical topologies have proved to be a viable alternative in a wide range of high-power medium-voltage applications, there has been an active interest in the evolution of newer topologies. Reduction in overall part count as compared to the classical topologies has been an important objective in the recently introduced topologies. In this paper, some of the recently proposed multilevel inverter topologies with reduced power switch count are reviewed and analyzed. The paper will serve as an introduction and an update to these topologies, both in terms of the qualitative and quantitative parameters. Also, it takes into account the challenges which arise when an attempt is made to reduce the device count[1].

II. MULTI LEVEL INVERTER

DC to AC power conversion is a key technology in the modern setup generation, transmission, distribution and utilization of electric power. Based on nature of the output wave form inverter can be classified as: square wave inverter, quasi-square wave inverter and multi-level inverter [1].

Multi-level inverter is having advantages such as:

(i) The staircase waveform reduces harmonic profile and also reduces dv/dt stress so that requirement of filter is reduced.
(ii) The voltage stress on the semiconductor device is reduced.
(iii)Renewable energy source can be used such as: photovoltaic, wind and fuel cell .
(iv)Multi-level inverter topologies offer the possibility to obtain a given voltage level with multiple switching combinations.

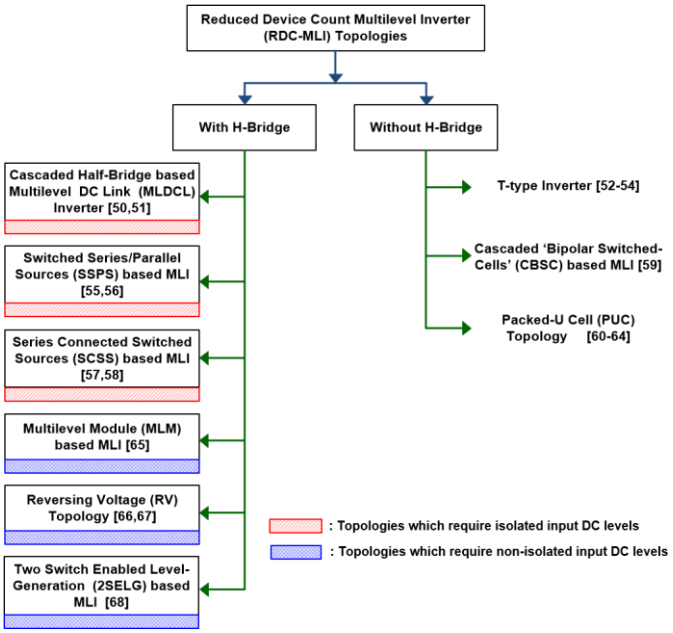
In view of the many advantage MLI are receiving much more and wider attention in term of topologies and control schemes.Multi level inverter having an important limitations for an increased number of output level they required a large number of power semiconductor switches So there will be increasing the cost, volume and complexity. Thus for past few year efforts are made to reduce the power switch count in MLIs and large number of topologies have appeared. These topologies have their own merits and demerits from the point of view application required. This paper represents the discussion and classification of the topologies.

2.1REDUCED DEVICE COUNT MULTI LEVE INVERTER:

This topology presented with an exclusive claim of reducing the number of controlled switching power semiconductor devices for a given number of phase voltage level are referred as (RDC-MLI) topologies.

These topologies are:

(i) Cascaded Half bridge based Multi-level DC Link(MLDCL).
(ii) T-type Inverter.
(iii)Switched series/ parallel sources(SSPS) based MLI.
(iv)Series connected switched sources(SCSS)based MLI.
(v) Cascaded Bipolar switched cells(CBSC) based MLI.
(vi)Packed U Cells(PUC).
(vii) Multi-level module(MLM) based MLI.
(viii)Reversing voltage(RV) topology.
(ix) Two switch Enable level-generation(2SELG) based MLI.



III. H-BRIDGE INVERTER

There are several types of multi-level inverter:

(i) Cascaded H-bridge.
(ii) Neutral point clamped.
(iii)Flying capacitor and others.

Among all the topology Cascaded H-bridge (CHB) inverters have been focused because of their modularity and simplicity. The number of output voltage levels increased by increasing no of H Bridge. However if the number of level increased the number of switching device is also increased which makes a multi-level inverter more complicated.

IV.SWITCHED SERIES/PARALLEL SOURCES

This paper represents a single phase multi-level inverter consisting of an H-bridge and dc sources which can be switched series/parallel, so this topology is referred as switched series parallel (SSPS)

A multi-level inverter with a small number of switching device is proposed. It consisting of an H-bridge and an inverter which output is multileveled voltage by switching the dc voltage sources in series and in parallel. The proposed inverter can output more numbers of voltage levels in the

same number of switching device by using the conversion. The number of gate driving circuit is reduced, which leads to the reduction of the size and power consumption in the driving circuit.

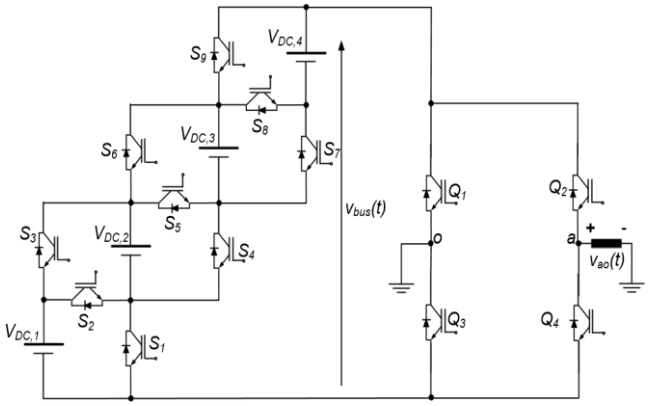
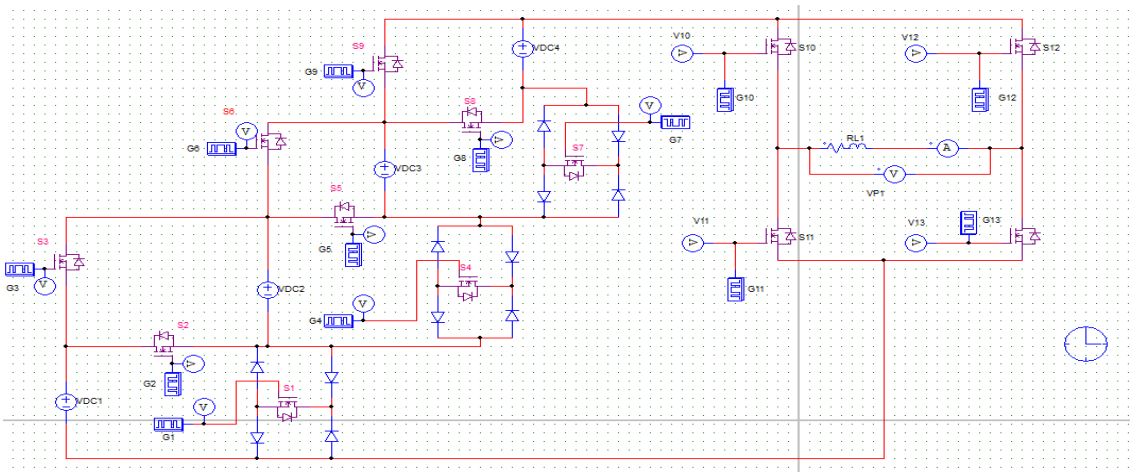


Fig:1 Circuit diagram of a SSPS

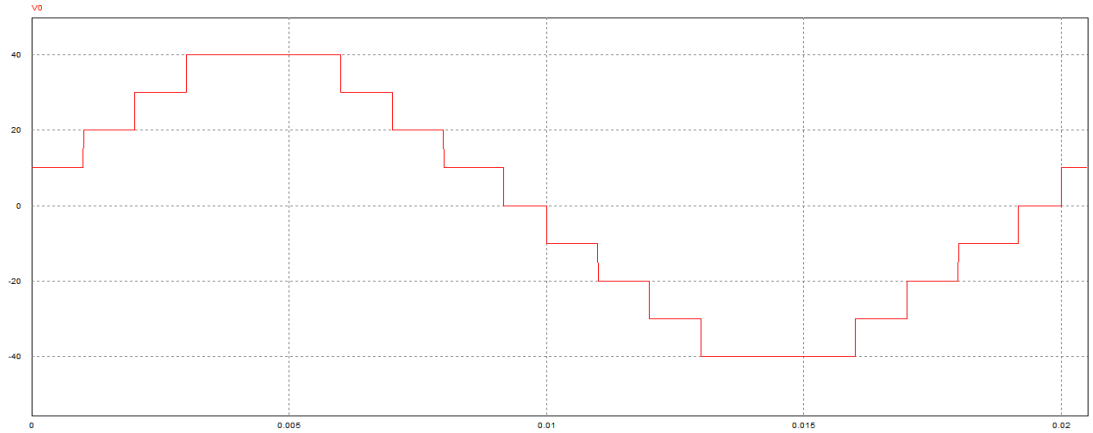
The topology requires the same of number of voltage sources as required by a cascaded H-bridge topology but it synthesizes same number of output levels with lesser number of power switches. An important application suggested is for electric vehicular applications where a single battery composed of a number of series-connected battery cells is available, which can be rearranged using the switched sources topology, hence reducing the requirement of switching devices. It gives us the possibility of combining two or more sources in series and parallel gives enough flexibility for meeting voltage/power requirements in the vehicle drive system[2]. This topology is having four input DC source and consists of two parts: Level generation part and Polarity generation part. Level generation part consists of switched sources and synthesize bus voltage Vbus(t) and having nine no of power switched Sw{w=1to9}.Polarity generation part consists of four power switch Mj{j=1to4} and which synthesizes positive and negative cycle of voltage VbusM(t) to supply to an AC Load (RL Load).It consists of four power switch Mj{j=1to4}

For a symmetric source configuration VDC,1 = $V_{DC,2}$ = $V_{DC,3}$ = $V_{DC,4}$ = V_{DC}. the voltage levels V_{DC} and $2V_{DC}$ can be synthesized with three states each while one state is available for voltage level$3V_{DC}$. Moreover, the voltage stress experienced by the switches S_j { j = 1 to 9 } in this case would be equal to V_{DC} each. An important limitation of this topology is that the switches M_j { j = 1 to 4 } need to have a minimum blocking capability equal to summation of voltages of all voltage sources. Thus, for the symmetric source configuration with four sources, the switches of polarity-generation part should possess voltage blocking capability of $4V_{DC}$. Another important limitation is that these switches with higher blocking capability cannot be operated at fundamental switching frequency because the zero voltage level is not synthesized by the switched sources [1, 2].

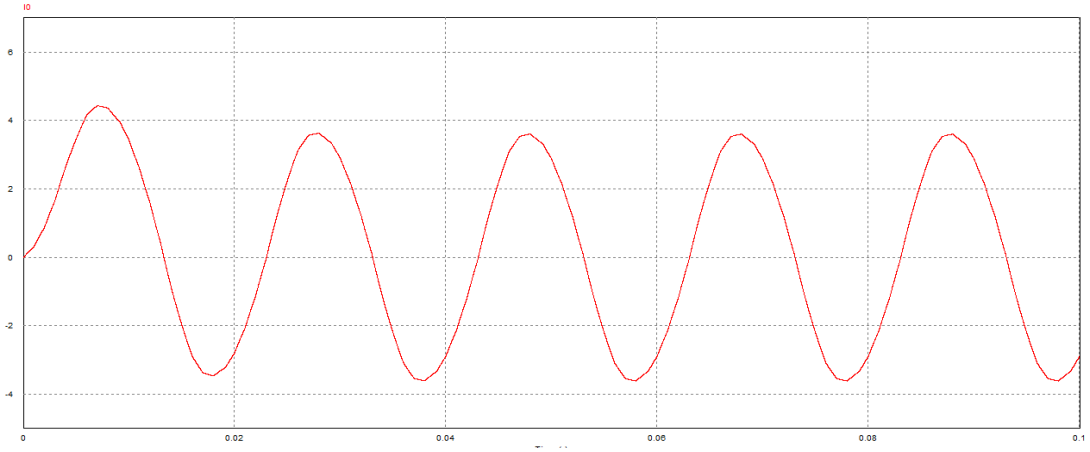
V. SIMULATION DIAGRAM OF SSPS



OUTPUT VOLTAGE



OUTPUT CURRENT



VI. CONCLUSION

In this paper a multilevel inverter which reduces the number of switching devices by switching the dc voltage source in series and parallel has been proposed. The modulation method and the analysis of harmonics in its output voltage wave form are shown. The simulation and experimental results are shown. The proposed inverter can reduced the number of switching devices compared with conventional multi level inverter in the same number of output voltage level.The simulation result are shown.

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