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Renewable based Multicarrier PWM Topology for Symmetric MLI

J. Gayathri Monicka[#1], K. Dwarakesh[#2], C.Amutha Devi[*3]
[#]Department of Electrical and Electronics Engineering,
Adhi College of Engineering and Technology,Kanchipuram, India.
[1]gayathri.eee@adhi.edu.in
[2]dwarakesh7281@gmail.com
*Department of Computer Science and Engineering,
Misrimal Navajee Munoth Jain Engineering College, Chennai
[3]camuthadevi@gmail.com

Abstract- **In this work, the operation and performance of photovoltaic fed Symmetric Cascaded Multilevel inverter (CMLI) is investigated and presented. CMLI is one of the widely used types of converter. Source for Multi-level inverters (MLI) is fed using a renewable energy system. A PV array has been designed using mathematical models. With increased number of levels at the output, harmonics content has been reduced and finds application at high power sectors. This work proposes CMLI with equal DC Sources, using various type of level shifting Multicarrier PWM technique. Owing to their ease, flexibility and less computational requirements, carrier based approaches have been widely used for switching the power semiconductor devices of MLI's. Harmonic performances have been improved by using PWM strategy for the modulated cascaded inverters. The design Performance of CMLI is evaluated by MATLAB/SIMULINK simulation. Harmonic spectrum of the system is improved by appropriate modulation technique.**

Keyword-Cascaded Multi-Level Inverter, PV cell, Pulse Width Modulation, Phase disposition,THD

I. INTRODUCTION

From last three decades, the area of high-power drives has become the most active research field, The Multilevel Inverter (MLI)approach allows using the high-power and high-voltage electric motor drive systems, which can be implemented using energy resources using equal distribution such as photovoltaics and fuel cells[1]. Few devices like ultracapacitors and batteries which store energyhave been used with MLI's.The required voltage have been obtained from different DC sources like battery and renewable energy system, this are blended through SDCSs with CMLI [2]. In recent times MLI has gained wide popularity in various grid and variable speed drive applications, coming to their advantages, MLI reduces the harmonics in the output waveform with no change in the switching frequency or reducing the output produced from inverter [3].CMLI is the most popular technique among diode clamped and flying capacitor as it has more advantages in harmonic reduction, low switching stress and high voltage gain[4- 6].The CMLI has the drawback as it needs separate dc sources, butmodularised circuit design is compact and it has no problem of voltage sharing. Hence it is easy to expand, it is applicable in high power motor drives. This paper reports the progress of control methods for cascaded multilevel inverters. Emerging Level shifting modulation control technique has been designed and discussed. Results are presented which reveal the efficiency for the proposed control.

II. CASCADED MULTILEVEL INVERTER

CMLI has a distinctive and attractive topology such as simplicity in structure, usage of lesser number of components. Required voltage for the CMLI is obtained from different sources of DC voltages obtained from battery or renewable energy system. The structure of single phase CMLI is depicted in Fig.1. Each separate DC source is associated with a single H-bridge. Five H- Bridges are present for eleven level symmetric CMLI. Source fed for the H-bridges H1, H2, H3, H4, H5 is DC source, V_{dc}. The AC terminal voltages of diverse levels are connected in series [7]. Through different combinations of the four switches (S1-S4), each inverter level can generate three different voltage outputs, $+V_{dc}$, $-V_{dc}$ and zero. In this topology, the count for output levels of the phase voltage is given by,

$$p=2q+1 \quad (1)$$

where, q is the number of DC sources , p is the number of levels. The maximum output phase voltage of these *q* CMLI is

$$V_0, MAX = q\, V_{dc} \quad (2)$$

The eleven level MLI output will be obtained as depicted in Fig. 2. Number of voltage sources used is five cells, i.e., referred from equation 1.Each cell consisting of a half bridge or full bridge combination of IGBT switches. The switching state for the 11 level inverter is given in Table 1.The switching patterns for the switches