

## ABSTRACT

Multilevel power conversion was first introduced 25 years ago. The general concept involves utilizing a higher number of active semiconductor switches to perform the power conversion in small voltage steps. There are several advantages to this approach when compared with traditional power conversion. The smaller voltage steps lead to the production of higher power quality waveforms and also reduce voltage ( $dv/dt$ ) stress on the load and reduce the electromagnetic compatibility (EMC) concerns [1]. Another important feature of multilevel converters is that the semiconductors are wired in a series-type connection, which allows operation at higher voltages. However, the series connection is typically made with clamping diodes, which eliminates overvoltage concerns. Furthermore, since the switches are not truly series connected, their switching can be staggered, which reduces the switching frequency and thus the switching losses. One clear disadvantage of multilevel power conversion is the larger number of semiconductor switches required. It should be pointed out that lower voltage rated switches can be used in the multilevel converter and therefore the active semiconductor cost is not appreciably increased when compared with the two level cases. However, each active semiconductor added requires associated gate drive circuitry and adds further complexity to the converter mechanical layout. Another disadvantage of multilevel power converters is that the small voltage steps are typically produced by isolated voltage sources or a bank of series capacitors. Isolated voltage sources may not always be readily available and series capacitors require voltage balance. To some extent, the voltage balancing can be addressed by using redundant switching states, which exist due to the high number of semiconductor devices. However, for a complete solution to the voltage-balancing problem, another multilevel converter may be required [2–4]. In recent years, there has been a substantial increase in interest to multilevel power conversion. Recent research has involved the introduction of novel converter topologies and unique modulation strategies. However, the most recently used converter topologies which are mainly addressed as applicable multilevel converters are cascade converter, neutral point clamped converter (NPC) and flying capacitor converter. There are also some combinations of the mentioned converters as series combination of a two level converter with a three level NPC converter which is named cascade  $3/2$  multilevel inverter and is depicted in Figure 1. Also series combination of three level cascade converter with a five level NPC converter which is named cascade  $5/3$  multilevel inverter and is shown in Figure 2 [5]. Some applications for these new converters include industrial drives [6–8], Flexible AC Transmission Systems (FACTS) [9–11], and vehicle propulsion [12, 13]. One area where multilevel converters are particularly suitable is that of medium-voltage drives [14]. This chapter presents an overview of a new multilevel inverter topology named Reversing Voltage (RV). The first section describes the general multilevel inverter schematic. A general method of multilevel modulation PD-SPWM is utilized that may be extended to any number of voltage levels. The final section shows simulation results of introduced inverter.