An Enhanced Single Phase Step-Up Five Level Inverter

Introduction:

In the past decade, renewable energy sources such as photovoltaic (PV)-based systems have attracted much more attention due to the advantages such as less environmental impact and improved economic benefits. With the rapid growth of power electronics technology, various converters topologies have been developed for PV systems. Among these topologies, multilevel inverters have been receiving significant interest due to the reduced total harmonic distortion (THD) and improved quality of output waveform. As the output voltage level increases, the output harmonic content of such inverters decreases, allowing the use of smaller output filters.

Existing system:

A single-phase five-level inverter using coupled inductors and the common three-arm power module, in which only one dc voltage source is needed and split of the dc voltage capacitor is also avoided, which eliminates the problem of dc capacitor voltage balancing with the conventional topologies. Meanwhile, six power switches with the same voltage stress and only one set of coupled inductors are adopted. Also, less inductor is needed in the inverter explained. With these modulation methods, no dc component exists in the inductor currents under all load conditions, which will benefit the full use of the magnetic cores and minimization of the inductors.
Drawbacks:
- Coupled inductors need to be carefully designed.
- High total harmonic distortion (THD).
- Low power quality of output waveform.

Proposed system:
The proposed single phase step-up five-level inverter consists of a single dc source, a conventional boost converter, a switch-diode-capacitor cell and an H-bridge. The diode-capacitor cell ($C1-D1$, $C2-D2$) and the inductor $L1$ are used to boost the dc-link voltage. The multilevel signal is generated by switch $S2$ and the diode capacitor cell. The proposed topology can implement the multilevel inversion with high step-up output voltage.
Advantages:
- Reduced number of power switches, diodes and a single dc source are used.
- Multilevel inversion with step-up output voltage is obtained.
- Only four switches work at high frequency whilst two switches work at low frequency (50 Hz), which helps to reduce the switching losses.
- Simple topology and easy control is achieved.

Applications:
- Uninterrupted power supply.
- AC module applications.
Block diagram:

- PV solar supply
- Boost circuit
- Switch diode capacitor cell
- H Bridge Inverter
- Load
- Isolation circuit
- 12V DC
- Driver circuit
- Buffer Circuit
- 5V DC
- Micro Controller Circuit