Maximum Boost Control of Diode-Assisted Buck–Boost Voltage-Source Inverter with Minimum Switching Frequency

Introduction:

The efficiency and environmental benefits of emerging solar and fuel cell technology, the distributed generation systems based on the renewable energy sources have rapidly developed in recent years. In photovoltaic (PV) systems, it is difficult to realize a series connection of the PV cells without incurring a shadow effect. Fuel cells and lightweight battery power supply systems are promising in future hybrid electric vehicle, more-electric aircraft and vessel. However, the obvious characteristic of these dc sources is low voltage supply with wide range voltage drop.

Power electronic interface has to regulate the amplitude and frequency to obtain required high ac utility voltage. These applications raise stringent requirements for power converters such as low cost, high efficiency and wide range voltage buck–boost regulation ability. Traditional voltage source inverter (VSI) can only perform buck voltage regulation.

Existing system:

Traditional two-stage VSI obtains the required output voltage by introducing dc–dc boost circuit in the front. In view of additional power conversion stage increasing cost and lowering efficiency,
family of Z-source inverter introduces a unique impedance network between the dc source and the inverter bridge. It achieves the desired output voltage that is larger than the available dc source voltage by adopting shoot-through (ST) operation mode.

Z-source inverter provides a potential cheap and single-stage power conversion. However, the ST state limits the modulation index and accompanies large ST current. Although both of them can boost output voltage to any desired value without upper limitation in theory, the degradation of efficiency and increasing requirement of switching devices are prominent under high voltage gain

Dis-advantages:
- More no of switching devices.
- Low efficiency.

Proposed system:
A new PWM strategy to achieve the instantaneous maximum utilization of intermediate dc-link voltage, as well as to reduce the switching frequency of power devices in diode-assisted buck–boost VSI. It extends voltage gain and avoids extreme boost duty ratio by introducing a switch-capacitor based high step-up dc–dc circuit between the dc source and inverter bridge.

The diodes are naturally conducting to perform capacitive charging in parallel and discharging in series to achieve high voltage gain. It regulates the average value of intermediate dc-link voltage in one switching time period $T_s$ the same as the instantaneous maximum value of three-phase line voltage by controlling the front boost circuit. It regulates the average value of intermediate dc-link voltage in one switching time period ($T_s$) the same as the instantaneous maximum value of three-phase line voltage by controlling the front boost circuit.
Advantages:

- Reduces the voltage stress of switches.
- Demonstrates the optimal efficiency.
- It is also suitable for relatively high output line frequency.

Applications:

- Renewable energy applications.
- Aircraft and vessel power supply system.

Block Diagram: