A NEW NON-ISOLATED DC-DC CONVERTER FOR HIGH VOLTAGE BOOST RATIO

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ABSTRACT

The topology of a floating output, voltage boost, non-isolated interleaved buck-boost DC-DC converter is proposed. Without utilization of transformers or coupled inductors, voltages are added symmetrically on both sides of the input DC bus in series, through two 180° phase shifted buck-boost sub-converters operating from each side of the input DC rails. This results in reduction of input current and output voltage ripples. Therefore, semiconductor and passive component ratings are also reduced compared to classical DC-DC boost converters. There is no subtraction of the total input voltage from the output voltages of the sub-converters. Since fraction of the load power flows in directly from the input, each sub-converter does not process the entire output power. This results in minimizing the current & voltage ratings of the semiconductor devices resulting in improving the overall system efficiency.

In the linear modulation range, the maximum fundamental voltage that can be generated across the motor terminal is less than the input AC voltage fed to the diode bridge rectifier. Further, supply voltage can dip by about 10%, either momentary or long term, which is common. Thus, it is essential to boost the DC bus voltage to maintain the rated AC voltage at the motor terminal despite the mentioned practical limitations.

A modified topology for efficiently boosting the DC bus voltage in a transformer-less 5-level Neutral Point Clamped (NPC), Voltage Source Inverter (VSI) based Open End Induction Motor (OEIM) drive is shown as the application of the proposed DC-DC boost converter. Out of the four separate voltage levels, the two middle levels are obtained by dividing the input DC voltage using a capacitor voltage divider. The top and bottom voltage levels are obtained from the sub-converters of the proposed DC-DC converter whose generated voltages are kept just sufficient to cater to the boost need, resulting in low additional power loss in the process of boosting the voltage.