A Quasi-Resonant Current-Fed Converter with Minimum Switching Losses

Introduction:

Renewable sources such as photovoltaic (PV) panels and fuel cells (FC) stacks have low-voltage and high-current characteristics, and require low current ripple.

In order to utilize these power sources, a dc–dc converter with voltage isolation, low input current ripple, and high step-up capabilities resulting in high efficiency is required. In addition, high switching frequency is essential for having a high-power density conversion.

Even so, high switching frequency causes some problems such as high switching losses, high voltage and/or current spikes, and electromagnetic interference. To eliminate these problems, soft-switching operation is employed in dc–dc converters. In order to provide the soft-switching condition, an auxiliary switch is added to a regular dc–dc converter.

Existing System:

The push–pull converter adopted in which the minimum number of components are used. However, it operates under hard-switching condition. So, the voltage spikes on switches increase converter losses dramatically. In, an active-clamped current-fed push–pull converter is introduced which adopted ZVS and lossless clamp circuit, which have improved its efficiency.
Although a current fed push-pull converter has been proposed in which adopted ZVS and ZCS for switches, it suffers from high voltage stress on switches. On the other side, the component numbers of converter and its complexity have increased which increases the cost.

Dis-advantages:

- High voltage stress.
- Component number of converter and its complexity have increased.

Proposed System:

A quasi-resonant dc–dc converter with high voltage gain and low current stresses on switches is proposed such that this converter preserved inherent advantages of current-fed structures, for instance, zero magnetizing dc offset, low input ripple, and low transformer turn ratio.

Moreover, by employing the active-clamp circuit, the voltage spikes across the main switch, due to the existence of leakage inductance of the isolating transformer, is absorbed, and switches work in zero voltage switching. Since quasi-resonant switching strategy is employed, turn-off current (TOC) and losses of switches are considerably reduced. Because of zero current switching (ZCS), reverse recovery problem of diodes is alleviated.

Advantages:
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- Galvanic isolation.
- Improves voltage gain.

Applications:
- High-power and low-voltage applications.

Block Diagram: