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Title: Medium Voltage Flying Capacitor DC/DC Converters with Zero Voltage Switching

Abstract
This study investigates advancements in SiC-based power converters, focusing on a multilevel DC/DC flying capacitor converter tailored for medium voltage applications. The investigation primarily revolves around the soft-switching quasi-square-wave (QSW) technique, which encompasses two key methodologies: quasi-2-level modulation and the integration of current sink capacitor method.
The proposed control method initially explores quasi-2-level modulation, aiming to enable zero voltage switching (ZVS) at turn-on across a wide operating range. Through simulations and experiments up to 1.5 kV DC and frequencies of 40-250 kHz, the converter achieves exceptional efficiency around 99%, positioning it competitively against traditional counterparts.
Subsequently, the focus shifts to enhancing the QSW technique by integrating the current sink capacitor method. This modification involves adding capacitors in parallel to each transistor to minimize turn-off power losses in SiC MOSFETs operated with ZVS. Experimental validation demonstrates a remarkable over tenfold reduction in turn-off power loss, even with nanofarad-range capacitances, without significantly increasing system complexity.
In summary, this presentation showcases the evolution of the QSW technique, initially explored with quasi-2-level modulation and later enhanced through the integration of the current sink capacitor method. These advancements offer a promising avenue for achieving high efficiency, reduced power losses, and improved performance in SiC-based power converters tailored for medium voltage applications.

Keywords:
DC-DC power conversion, power converter, zero voltage switching, SiC power MOSFETs.