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Hybrid Space Vector PWM Schemes for Interleaved Three-Phase Converters

Three phase PWM converters are widely used in numerous applications including adjustable speed motor drives, uninterruptible power supplies and grid integration of renewable and distributed resources such as solar photovoltaics. Some of the important metrics of performance for these converters are related to the amount of total harmonic distortion (THD) in the line current, switching losses in the power devices and dynamic performance. Modular converters are also becoming increasingly popular for high power applications due to the advantages of reduced voltage or current ratings for the individual switching devices, reduced current or voltage ripple (hence smaller filter size) by utilizing interleaving, unified design and increased reliability through redundancy. Interleaving refers to appropriately phase shifting the PWM signals to the different modular converters in such a way that the ripple content in the individual converter currents tend to cancel each other in the total line current.

Researchers at Arizona State University have developed hybrid interleaved space-vector PWM schemes for parallel-connected modular three-phase converters. The proposed schemes result in superior performance especially in terms of reduced THD in the line current drawn by the interleaved converters, compared to conventional schemes. These hybrid schemes make use of certain new space vector PWM sequences that were originally developed at ASU for single converter applications to reduce distortion and switching loss. The invention disclosed here extends these concepts and sequences to interleaved, modular converter applications. The process of developing the new hybrid schemes involves selecting the optimal sequences as well as the optimal phase shift among the modular converters in each switching cycle.

Potential Applications

- Uninterruptible Power Supplies (UPS)
- Grid Tie Renewable Resources (Photovoltaic Energy)
- Adjustable Speed Motor Drives

Benefits and Advantages

- Greatly reduced total harmonic distortion ? typical reduction of about 40% with max reduction of 67%
- Significantly reduced filter size
- Reduced switching losses
- Reduced losses in the AC filter capacitor