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P4.079 Research on Synchronization Technology of High-power Converters

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In the Poloidal Field (PF) Power-supply System of International Thermonuclear Experimental Reactor (ITER), the phase-control thyristor converter is used to supply power to the PF superconducting coil. A precise zero scale is provided for the thyristor trigger by synchronization technology. The method of extracting the synchronization signal on the rectifier transformer primary side is widely used. However, the operation performance of the ITER PF converter is seriously affected by the dynamic phase difference because of the leakage inductance of the rectifier transformer. An approach to extract the synchronization signal on the secondary side of the rectifier transformer is proposed. Then, an improved three-phase phase-locked loop method named frequency adaptive moving average filter PLL (FAMAF-PLL) is proposed to eliminate the effect of the unbalanced voltage and characteristic harmonics. This method can accurately realize real-time synchronization and effectively improve the PF converter performance. Finally, the reliability and accuracy of the proposed synchronization technology is verified by simulation and experimental results.

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