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Design of Inverter Module on RMP coil Power Supply in EAST

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In Experimental Advanced Superconducting Tokamak (EAST), Resonant Magnetic Perturbation (RMP) coils, which are powered by RMP coil Power Supply (PS), are set to research Edge Localized Mode (ELM), Resistive Wall Mode (RWM) and Error Field Correction (EFC). The RMP coils are grouped in 8 sets with 2 coils in series as 1 set. And the 8 sets of coils are respectively powered by 8 sets of PSs.
To generate a wide range of perturbation, the RMP coils will be supplied independently by DC or AC with the amplitude up to 2.5 kA in the frequency range of 50 Hz to 1 kHz. The maximum output voltage is 408 V. For further research of physicists, the output voltage and current should be up to 450 V and 4 kA. The current latency time should be less than 0.35ms (0-2.5 kA*50%) while the voltage latency time should be less than 0.25ms (0-450 V*50%). And the rise rate for voltage and current should be larger than 300 V/ms and 5 kA/ms. The voltage ripple should be less than 2% of output voltage, when the output voltage is less than 5% of the rated value, the voltage ripple should be less than 10%.
To meet the design requirements of output current, output voltage, current and voltage latency time and output voltage ripple, the switch frequency of IGBT, equivalent output frequency, RC compensation branch and topology structure should be designed carefully. The specific design progress including theoretical analysis and simulation results are given. The test results about different design requirements validate the correctness and reasonability of the scheme.
By applying carrier phase shifting PWM between branches, the ripple of output voltage can be reduced, and the equivalent switch freqyency has increased. And the whole 8 sets of RMP coil PSs have been put into use in the latest EAST experiment. Until now, they can have an effect on ELM control according to the physical experimenters.

Eligible for student paper award?

Yes

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