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# A new synchronization method based on compensation of phase deviation for pulsed generator power supply

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At Wuhan National High Magnetic Field Center, a 100 MVA/100 MJ pulsed generator and two 67.5 MW converter modules have been installed as power supply for pulsed magnets. This power supply can energize magnets alone or with other power supplies. Long-pulsed magnetic field with 50 T/100 ms flat-top has been produced, and 100 T pulse magnetic field is under commissioning. In those high power occasions, the three-phase voltages undergo serious harmonics, large notches, amplitude variation, rapid frequency fluctuation and phase jump simultaneously. In order to guarantee the security operation of the system and quality of magnetic field wave, synchronization method with both fast dynamics and excellent harmonics rejection is expected, which is difficult for conventional synchronous reference frame PLL (SRF-PLL). Therefore this paper presents a new open-loop synchronization method based on compensation of phase deviation. In this method, the phase of three-phase voltages, which is achieved by summing filtered phase deviation and phase of a given d-q rotating reference frame, is open-loop computed directly. The phase deviation would be determined through making the division of vd and vq and a subsequent arctangent, while the vd and vq are obtained by applying given d-q rotating reference frame for Park's transformation. Then the phase deviation is filtered by a designed fourth-order filter to reject the influence of harmonics and estimate the frequency. Due to direct computation of phase, dynamics of this synchronization method is independent of voltages amplitude, meanwhile the specialized filter contributes to faster dynamics and better harmonics rejection. Experimental results in comparison with SRF-PLL are used to validate the better performance of the proposed method. Finally the proposed method has been applied to the pulsed generator power supply, a magnetic field wave with 40 T/100 ms flat-top is produced, and the ripple during the flat-top is less than 0.2%.

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