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An Innovative Method for generating High-Stability Flat-Top Pulsed Magnetic Field

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The high stability flat-top pulsed magnetic field has both high field strength and high field stability simultaneously. That is necessary for some high precision scientific experiment, for example, nuclear magnetic resonance (NMR) and heat specific measurement, whose resolution of experimental data is closely related to both field strength and field stability.

In this paper, an innovative method for generating high stability flat-top pulsed magnetic field base on battery power supply is proposed. In this system, a new modified active filter including a bypass circuit and a divider resistor is developed. The bypass circuit is in parallel with the magnet to form a parallel branch, with which the divider resistor is in series. Different from traditional application, the bypass circuit consisting of IGBTs works as a controllable constant current source rather than in the switch model. The current of bypass circuit can be adjusted by the driving voltage of IGBTs to achieve the continuously regulation of the voltage division ratio between divider resistor and magnet, then the current of magnet maintain stability and high stability flat-top pulsed magnetic field can be obtained. In order to generate the 40T/100ms flat-top pulsed magnetic field with the ripple of 100ppm, three parallel FZ3600R17HP4 IGBTs and $5m\Omega$ divider resistor are used, the driving voltage of IGBTs are controlled by a high speed digital PID system with DSP28335 and the feedback signal is the magnetic field measured by pick-up coil.

The designed system can provide high-stability flat-top pulsed magnetic field and offer better experimental physical environment for NMR and heat specific measurement.

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