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A High Energy Hybrid Pulsed Power System for Multi-coil Magnet

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High pulsed magnetic field is an important research tool for frontier science. In order to achieve 100 Tesla pulsed magnetic field, a high energy hybrid pulsed power system consisting of pulsed generator, battery banks and capacitor banks is designed to energize the magnet at the Wuhan National High Magnetic Field Center (WHMFC). The magnet has a structure of three coaxially nested coils. The outer coil is powered by pulsed generator and battery banks in series, the middle coil and the inner coil are energized by capacitor banks separately. Each coil of multi-coil magnet is fired in designed sequence. Because of the coupling effect between the outer coil and the middle coil, the current of the outer coil will drop when the middle coil is fired. And this current drop will bring adverse effects that the burden of the power supply and the stress of magnet increase. To ensure safety and reliable operation, the current drop of the outer coil should be reduced as far as possible. Based on the mathematic model of the high pulsed magnet power supply established in this paper, the mutual voltage causing current drop can be derived. And an auxiliary power supply composed by capacitors is adopted to restrain the current drop in the outer coil. The parameters, circuit topology and control strategy of capacitors are also discussed. To verify the validity of the design scheme, the simulation model is established, and the result shows that the auxiliary power supply can restrain current drop dramatically.

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