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Design of a hybrid power supply for the 65 T high-stability flat-top pulsed magnetic field

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With the increasing applications in physics, biology, chemistry and many other basic scientific fields, high-stability flat-top pulsed magnetic field is demanded for a higher field intensity and a lower ripple. To meet this demands, this paper proposes a hybrid power supply to generate a high-stability flat-top pulsed magnetic field at the Wuhan National High Magnetic Field Center. The hybrid power supply which is adopted to energize a dual-coil magnet, consists of an 11 MJ/25 kV capacitor power supply and a 100 MVA generator-rectifier power supply. A coupling transformer is adopted in the circuit to compensate the influence of the mutual coupling between the two coils. To protect the system from the damage of a short circuit fault occurring between the first turns of the inner coil and outer coil, which will produce oscillation voltage with a high peak value and high frequency (45 kV and 776.6 kHz) on the rectifiers, a protection circuit consists of an R-C branch, a diode array and a metal-oxide arrester is presented. The self-adaptive PI controller with the coefficients corrected by back propagation neural network is adopted to reduce the ripple of flat-top. The MATLAB/SIMULINK is used to model and simulate the proposed system, and a 65 T/100 ms high magnetic field with a ripple less than 160 ppm is generated. Acknowledgements: The National key research and development program of China (2016YFA0401702) and the Program for New Century Excellent Talents in University.

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