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A Novel Design of Multi-coil Magnet System for 100 T

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For high magnetic field, the pulsed magnets are normally designed with multiple coils. However, the magnetic field produced by the outer coil starts to drop at the moment when the inner coil starts working due to the electromagnetic coupling. Simulations show that the field drop is as much as 30% if the outer coil is driven by pulsed generator, with the result that the coil has to be designed to endure the magnetic force at the peak field but it contributes 30% less field. A novel scheme is proposed to eliminate the field drop by introducing compensation electromotive force in the coils. A triple-coil pulsed magnet and triple-coil transformer have been designed and manufactured. The inner, middle and outer coils of the magnet are connected in series with the inner, middle and outer windings of the transformer, and are energized with capacitor banks and pulsed generator. Experimental results show that the magnetic field produced increases from 8 T to 15 T with increasing the magnetic force in the outer coil, which proves the feasibility of the new scheme and the potential to produce 100 T.

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