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## Step-current method for improving energy storage density of superconducting magnet

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It has previously observed that superconducting magnets have been conventionally excited by a unified current which limited by the largest perpendicular magnetic field usually on the top of magnet due to anisotropic properties. In this case, the current carrying capacity of these pancake windings except that on the ends of the magnet can't get fully used. This paper provides a new method to improve the energy storage density by applying step-currents on pancake windings according to the different perpendicular magnetic field on the different position. A iteration method is proposed to obtain the critical step-currents. The paper establishes the finite element models of double solenoid magnet and toroidal magnet. The two kinds magnets with step-current are analyzed and the variation trend of the perpendicular magnetic field, central magnetic field, critical currents, storage and mechanical stress are given to verify its feasibility.

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