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Tue-Mo-Po2.06-06 [37]: Analysis of Gradient-Induced Eddy Current in a superconducting MRI Magnet

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In superconducting magnetic resonance imaging (MRI) systems, time-varying eddy currents in the conducting cryostat structures are induced by switched gradient coils. These eddy currents increase thermal loads of the cryostat, create acoustic noise, lead to image distortion and limit the application of fast MR sequences. In this paper, a fast coupled circuit network method is employed to calculate the eddy current in the cylindrical cryostat structures induced by an active-shielded longitude gradient coil, with the consideration of temporal characteristic, exponential decay along the radial direction and skin depth. Also, the detrimental effects including powder deposition in the magnet cryostat and secondary magnetic field generated by the eddy currents are analyzed. To verify the accuracy, the eddy current measurements were carried out and compared with the calculated results. In addition, the eddy current distribution variation and related effects on magnet and gradient field caused by different axial mounting errors of the gradient coil were analyzed and discussed in detail. These results could provide meaningful engineering implication for improving the reliability and stability of superconducting MRI systems.

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