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Electromagnetic behavior of striated coated conductors wound into pancake coils

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Large magnetization of coated conductors is one of the most serious concerns of their applications to MRI or NMR magnets, because it deteriorate the uniformity and stability of the magnetic fields. As the counter measure against large magnetization, the striation of coated conductors was proposed, and its effect was demonstrated in small coils. Even if filaments (narrow conductor strips in a striated coated conductor) are insulated electrically, filaments are connected one another electrically at both ends of the coated conductors. Therefore, a current can circulate through both ends, and its decay time constant should be large. Of course, MRI or NMR magnets are not operated at 50 / 60 Hz, and, if the decay time constant of the circulating current is small enough as compared to the time scale of the operation of a magnet, the striation might be effective. We study the electromagnetic behavior of striated coated conductors wound into pancake coils through numerical electromagnetic field analyses. The length of conductors, resistances between filaments at the ends, the magnetic field to which a conductor is exposed in a coil, the ramping up rate of the current and the magnetic field, etc. are varied to look at their influence on the decay time constant of the circulating current, in other words, the current imbalance between filaments. We also vary the resistance between filaments (not insulated completely). Based on the numerical results, the effect of striation is discussed.

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