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Wed-Af-Po.05-05: Numerical electromagnetic field analyses of multifilament coated conductors with improved current-sharing properties

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When considering the application of coated conductors to ac equipment such as motors and generators, it is necessary to reduce ac losses, especially hysteresis losses caused by external ac magnetic fields, by multifilamentation. In multifilament coated conductors, the finer the filament, the better, since the overall hysteresis loss is reduced inversely proportional to the filament width. However, if the filaments are thin, there is concern that the current flowing through each filament may be blocked by local defects, resulting in deteriorated current transport characteristics of multifilament coated conductors. Therefore, when thinning the filaments, a current path that allows current-sharing among filaments to make current bypassing local defects is essential to maintain the current transport characteristics of the multifilament coated conductors.

We have performed numerical electromagnetic field analyses for straight and spiral multifilament coated conductors with improved current-sharing properties to evaluate their ac loss characteristics. These multifilament coated conductors have a structure in which the filaments are locally connected by inter-filament superconducting bridges. The longitudinal spacing of the inter-filament bridges is varied, and the ac loss characteristics of the multifilament coated conductors with inter-filament bridges are compared with them of conventional monofilament and multifilament coated conductors. For the ac loss characteristics, only an external ac magnetic field is applied, and the dependence on the amplitude and frequency of the external magnetic field is evaluated.

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