A New Numerical Approach to Find Current Distribution and AC Losses in Coaxial Assembly of Twisted HTS Tapes in Single Layer Arrangement

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Abstract - This paper presents a novel technique for evaluating AC losses and current distribution in single layer assemblies of coaxially wound thin conductors, such as YBCO coated conductors. The proposed approach takes into account the twisted geometry of the individual superconducting tapes by considering the integral relation between the magnetic vector potential and the current density in the tapes (Biot- Savart formula). The integrals are solved numerically and semi-analytically, and the results are used to generate a discretized system of equations based on the magnetic flux diffusion equation (eddy current problem). The latter is solved using an efficient time transient solver (DASPK). It is assumed that, due to the helical symmetry of the problem, it is sufficient to solve for the current distribution in half of a single tape cross-section, even if many tapes are present, which allows a drastic reduction of the 3-D problem to a simple 1-D domain. The method was used to evaluate the AC losses of a HTS cable made of coated conductors, and it was observed that for a given radius of the former and number of tapes, twisted tapes with smaller pitch have lower AC losses.

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