Calculation of alternating current losses in stacks and coils made of second generation high temperature superconducting tapes for large scale applications

A homogenization method to model a stack of second generation High Temperature Superconducting tapes under AC applied transport current or magnetic field has been obtained. The idea is to find an anisotropic bulk equivalent for the stack such that the geometrical layout of the internal alternating structures of insulating, metallic, superconducting, and substrate layers is “washed” out while keeping the overall electromagnetic behavior of the original stack. We disregard assumptions upon the shape of the critical region and use a power law E-J relationship allowing for overcritical current densities to be considered. The method presented here allows for a computational speedup factor of up to 2 orders of magnitude when compared to full 2-D simulations taking into account the actual dimensions of the stacks without compromising accuracy.

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