Coil Optimization for HTS Machines

An optimization approach of HTS coils in HTS synchronous machines (SM) is presented. The optimization is aimed at high power SM suitable for direct driven wind turbines applications. The optimization process was applied to a general radial flux machine with a peak air gap flux density of ~3T. The proposed coil design is optimized with respect to minimizing the perpendicular field while still maximizing the amplitude of fundamental space harmonic. This guarantees the lowest HTS loss density and best utilization of expensive HTS material in the field winding of the SM. Additionally, accounting for different tape parameters Ici, ni and Ci, where Ici, ni and Ci are critical current, n - value and price of the ith tape respectively and i=1, 2, 3,…, further optimization with respect to cost vs. HTS losses has been performed. Allowing for different types of HTS tapes in the coils, a guidance to which tape is suitable for which coil segment is presented. Thus, the performed study gives valuable input for the coil design of HTS machines ensuring optimal usage of HTS tapes.

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