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## **Wed-Mo-Po3.13-07 [115]: Evaluation of Power Losses in High-temperature Superconducting Coils for Field-excited Electric Motors**

*Wednesday, 25 September 2019 09:30 (1h 45m)*

High-temperature superconducting (HTS) machines received tremendous attention recently in the high power applications such as wind power generators and electric propulsion for ships, as they offer both high power density and high efficiency with the improving performance of HTS windings. In conventional HTS motors, HTS field windings are commonly constructed with HTS coils which supplied with DC current to produce the excitation field, so they are usually mounted on the rotors. Due to the complicated structure and high cost of the associated rotating seals located at the cooling Dewars, the application of rotor HTS windings are limited. Recently, a new kind of motor with static seal, whose HTS field-excitation coils and armature windings are both located at the stator, was proposed and received many attention. When the HTS field-excitation coils are located on the stator, the complicated cryogenic coupling device and high mechanical strength torque tube can both be eliminated, hence operational reliability be improved and reducing costs.

Traditional analytical methods can only be applied on models with simple superconductor (SC) geometry and unchanging field, e.g. circular SC. Other than circular SCs, there are many researches on rectangular SC. However, no analytical results can be obtained. Numerical methods such as finite element analysis (FEA) was used to simulate the partial differential equations. COMSOL Multiphysics will be used in this analysis, it works under the framework of FEA and could solve complex simulations accurately and quickly.

A cross-section model of a multi-stack rectangular SC coil will be created and investigated, while the AC losses when the coil was subjected to a transport current of 10 to 100%. Detailed design and construction of a race-track HTS winding, Dewar, analysis and evaluation of a multi-stack HTS tape will also be presented in full paper.

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