MT 26
International Conference
on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **683** Type: **Contributed Oral Presentation**

Wed-Mo-Or11-04: Magnetic vector potential-based formulations for modeling superconducting applications: a valid alternative to the H-formulation

Wednesday, 25 September 2019 12:30 (15 minutes)

In recent years, the H-formulation of Maxwell's equation has become the de facto standard for simulating the time-dependent electromagnetic behavior of superconducting applications with commercial software. However, there are several situations where the H-formulation is not the most suitable tool. These include for example: i) situations where the superconductor is better described by the critical state than by a power-law resistivity; ii) HTS coated conductor coils with an excessively large number of turns; iii) electrical machines with materials with non-linear magnetic properties. In order to accurately and efficiently handle those situations, we discuss here two approaches based on the magnetic vector potential: the Campbell model and the T-A formulation. In this contribution, the Campbell model is for the first time implemented in the Comsol Multiphysics software package, without the need of resorting to external Matlab subroutines for the time-step algorithm. In addition, the T-A formulation is extended to 2-D conductors so that large coils with different coupling scenarios between the turns can be considered. Both models are first validated against experiments and simulation benchmarks, and then used to investigate cases of practical interest such as AC ripples in HTS coated conductors and AC losses of electrical machines with superconducting stator coils.

Primary author: GRILLI, Francesco (Karlsruhe Institute of Technology)

Co-authors: BENKEL, Tara (Karlsruhe Institute of Technology); BRAMBILLA, Roberto; ZERMENO, Victor (NKT)

Presenter: GRILLI, Francesco (Karlsruhe Institute of Technology)

Session Classification: Wed-Mo-Or11 - Magnetization and AC Losses in Conductors and Coils