



Contribution ID: 3

Type: **not specified**

Development of a three-dimensional finite-element model for high-temperature superconductors based on the H-formulation

Thursday 13 October 2011 10:00 (30 minutes)

Finite-element models are a powerful and widely used tool for evaluating the ac losses of HTS tapes and wires as well as of assemblies such as cables and coils. The H-formulation, which uses the magnetic field components as state variables, has proved to be an efficient implementation to solve 2-D problems, involving infinitely long or axially-symmetric geometries. However, the simulation of certain applications requires a fully 3-D model. In this paper we report on the development of a 3-D model based on the H-formulation. We describe in detail the implementation of Maxwell's equations, the imposition of current constraints and we discuss the issues related to meshing 3-D volumes. The obtained results are compared with analytical expressions based on the critical state model, if available, or with the results obtained with 2-D representations of 3-D problems

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Session Classification: Session 3: Electromagnetics, Models and Methods