HTS modelling workshop 2016

Grid oriented modelling/open source codes and apps (session 7)

Chairmen: F. Trillaud, V. Sokolovsky

Practical considerations on the use of Jc(B, θ) in numerical models of the electromagnetic behavior of HTS
(Francesco Grilli, invited)

- Self-field of the stack of tape to be taken into account
- A fast parameter-free method has been proposed to reproduce with a high accuracy the Jc(B, θ) of tapes
- The total field is actually the key parameter to define the Jc(B, θ) and not only the self-field
- How representative a short piece used for Jc(B, θ) for the whole tape?
- Available open source codes to compute Ic of devices

Multiscale model of resistive-type FCLs implemented in EMTP-RV power system electromagnetic transient simulator (Frédéric Sirois)

- Detail thermal-electric model of resistive ScFCL (circuit model)
- The conductor is subdivided into interconnected blocks (level of detail can be tuned) and lumped into a submodule of EMTP-RV (will be made available)
- Fine details of the electrical and mostly thermal behavior of the conductor in the ScFCL can be unveiled (hot spots)
- The ScFCL design should allow nominal state recovery under no fault condition baring large rush current (example with a transformer)

Numerical simulations of an inductive type FCL based on electromagnetic and temperature dependent parameters (Pedro Arsénio)

- Inductive configuration (YBCO coil on saturated core)
- Tool development: Reverse engineering simulation (fast method: few seconds) in Matlab/Simulink and coupling Matlab/Simulink with Cedrat Flux 2D (slower method: 2 to 5 days)
- Measurements on a small sub-scaled prototype were carried out and successfully compared to the numerical model (coupled electromagnetic-thermal model)
- Slight discrepancies between numerical and measured data. Good agreement between models

HTS modelling using Gmsh/GetDP (F. Trillaud)

- Rather mature free Software developed at the Université of Liége, Belgium.
- Mixed nodal (air) and edge element regions (conductors) approach is built-in (notions of cuts and global quantities allowing coupling with circuit as well)
- Somewhat complicated underlying theory revolving around de Rham's Cohomology (introduction of the subject). However, only general concepts are required to benefit from the full features of the software
- The presentation recompiles the basic information necessary to link the mathematical model and its implementation in Gmsh/GetDP

Stand-alone maglev simulator for portable devices (Antonio Badía)

- Application developed on Android device
- 2D model with a permanent magnet and a superconducting bulk
- User defines trajectory for the magnet
- Computation of current distribution and field lines
- Non linear computation done on cluster and creation of data base and on the application performs linear and post-processing operation