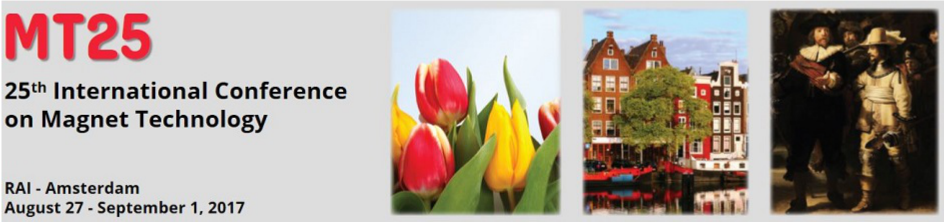

Contribution ID: **455** Type: **Regular 15 minutes Oral Presentation**

Development of a new generic analytical modeling of AC coupling losses in cable-in-conduit conductors (CICCs).

Monday, August 28, 2017 4:15 PM (15 minutes)

The determination of coupling losses induced in cable-in-conduit conductors (CICCs) when subject to time-varying magnetic field is a major issue commonly encountered in large fusion tokamaks (e.g. JT-60SA, ITER, DEMO). The knowledge of these losses is crucial to determine the stability of CICCs but is yet difficult to achieve analytically in a satisfying way given the specific and complex architecture of these conductors: superconducting and copper strands twisted together in several helical cabling stages. Numerical modeling however, by THELMA and JACKPOT, already provided solutions. In an attempt to ease the resolution of this problem, we have previously presented a theoretical generic study of a group of strands twisted helically together (representative of a single cabling stage of a CICC) and analytically derived the expressions of coupling losses using the electrical and geometrical properties of the conductor. We have now up scaled this analytical study to a two cabling stages conductor and derived the expressions of its time constants and partial shielding coefficients which, in the Multizone Partial Shielding (MPAS) model, are used to model coupling losses and determined experimentally (e.g. JT-60SA TF conductor). We derive these coefficients as functions of the effective electric and geometrical parameters of the conductor and present an iterative method to model coupling losses in a N cabling stages CICC. In a second part, the real strand trajectories of JT-60SA TF conductor obtained via X-ray tomography are used to find the effective geometrical parameters needed in our modeling, and the experimental coupling losses of this conductor determined from tests within Sultan facility enables us to apply our modeling on a real case to discuss its validity. Furthermore, we compare our results to these of THELMA and JACKPOT numerical modelings on specific geometries. This modeling opens new perspectives for the study of CICCs (e.g. stability and dimensioning).

Submitters Country

France, Italy, Netherlands, Romania

Primary author: Mr LOUZGUITI, Alexandre (CEA)

Co-authors: Dr TORRE, Alexandre (CEA); Mrs RICCHIUTO, Anna Chiara (Bologna University); Mr V A, Anvar (University Of Twente); NIJHUIS, Arend (University of Twente); Dr TURCK, Bernard (ITER); Dr CIAZYNSKI, Daniel (CEA-IRFM); Dr TOPIN, Frédéric (Aix Marseille Université); Dr TISEANU, Ion (INFLPR, Bucharest); DUCHATEAU, Jean-Luc (CEA); Dr ZANI, Louis (CEA); Mr BIANCHI, Marco (Bologna University); Prof. BRESCHI, Marco (Bologna University); BAGNI, Tommaso (University of Twente)

Presenter: Mr LOUZGUITI, Alexandre (CEA)

Session Classification: Mon-Af-Or4

Track Classification: B1 - Superconducting Magnets for Fusion