A GLOBAL STRUCTURAL AND ELECTROMAGNETIC FE MODEL FOR THE PREDICTION OF THE MECHANICAL BEHAVIOUR OF THE JT-60SA SUPERCONDUCTING MAGNET SYSTEM

V. Tomarchio[1], P. Barabaschi[1], D. Duglue[1], N. Hajnal[1], L. Meunier[1], G. Phillips[1]

[1] *Fusion for Energy – F4E, Boltzmannstrasse 2, D-85748 Garching, GERMANY*

Corresponding author: valerio.tomarchio@f4e.europa.eu

The JT-60SA is a fusion experiment designed to contribute to the early realization of fusion energy, by providing support to the operation of ITER, by addressing key physics issues for ITER and DEMO and by investigating how best to optimize the operation of the next fusion power plants that will be built after ITER. It is a combined project of the JA-EU Satellite Tokamak Program under the Broader Approach (BA) Program and JAEA's Program for National Use, and it is to be built in Naka, Japan, using the infrastructure of the existing JT-60U experiment.

The superconducting magnet system of JT-60SA consists of three sub-systems: a Central Solenoid split in four segments, a set of six Equilibrium Field coils and a set of eighteen Toroidal Field coils. Such systems are connected each other by means of a series of flexible and kinematic mechanical attachments, with the Toroidal Field magnet acting as the backbone of the whole magnet system. This is then supported to the cryostat base of the machine through a series of kinematic gravity supports.

A detailed finite element model, representing a 40 degrees sector of the superconducting magnet system of JT-60SA, has been developed and a complete set of analyses were carried out to obtain the distribution of magnetic forces acting on the three magnet sub-systems during all main operational scenarios, to predict the corresponding deformation of the complete magnet system, to estimate the stress levels arising in the magnets' mechanical support structures and to verify the integrity of the system and its fatigue life, in agreement with the applicable codes and standards and with the expected lifespan of the machine.

This paper illustrates the details of the modeling strategy which lead to the production of the finite element model and provides a comprehensive report and a critical analysis of the most relevant results obtained in the calculations carried out so far.