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P3.095 Mechanical Analysis of the DTT central solenoida

Wednesday, 19 September 2018 11:00 (2 hours)

The “Divertor Tokamak Test” facility, DTT, is a project for an experimental tokamak reactor developed in Italy, in the framework of the European Fusion Roadmap.
In this design phase of the machine it is necessary to ensure the structural integrity of the superconducting magnets.
This work focuses on the analysis of the stresses that are generated in the central solenoid of the tokamak, the CS system, a coil composed of 6 stacked and independently energized superconducting modules, wound from Nb_3Sn Cable In Conduit Conductors, working in a pulsed regime.
The peak of magnetic field reached on the coil is about 13.5 T and the whole structure must be cooled down to 4.5 K, operating temperature in which the cables work in the superconducting phase.
The electromagnetic loads generate a field of Lorentz forces on the magnet with predominantly centrifuge action, leading the coils to open and counteracting the contraction effect due to the cooling of the magnet.
It is very important to evaluate the stress behavior in the jackets of the superconducting cables, which perform the main structural support action and perform the containment of the refrigerant helium circulating in the cables, and the insulation of the coil.
Therefore, an FEM model has been defined to carry out a numerical simulation. The model includes full detail of the axisymmetric section of the coil, including the superconducting material, the 316-LN steel of the jacket and the filler and insulating resin with their specific properties.
The model also considers interactions and exchanges of forces between the 6 CS modules, thanks to the implementation of the contact elements.

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