



Contribution ID: 240 Contribution code: THU-PO3-205-07

Type: Poster

Engineering the main structures of the DEMO fusion reactor magnet system

Thursday 18 November 2021 10:00 (20 minutes)

The Roadmap to Fusion Electricity draws on innovative experiments pivotal for the accomplishment of the European DEMO, i.e. the demonstration fusion power plant by the EUROfusion Consortium. At the end of the pre-conceptual design phase, the machine comprises three main magnetic systems: 6 poloidal field (PF) coils, 16 toroidal field (TF) coils and the central solenoid (CS), primary member of the ideal transformer in which the induced plasma is the secondary. Tokamak reactor operates under extremely heterogeneous and demanding loading conditions, leading structures and components near to the materials mechanical limits. All the structures must be assessed under the static and fatigue structural viewpoint. This work presents the advanced global model for the DEMO machine. This model consists of the main magnetic system, structures, auxiliary components, and joint connections. All the updated timepoints of the actual Single Null scenario have been analyzed via a dedicated electromagnetic FEM model. The routine adopted allows to analyse each magnet and each component with a fully detailed submodel and/or with a homogenised model and equivalent thermoelastic material properties.

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Session Classification: THU-PO3-205 Fusion V: Toward DEMO