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P4.072 Electromagnetic loads on ITER low field Side reflectometer in-vessel components

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The current design for the ITER Low Field Side Reflectometer (LFSR) diagnostic system contains six double-walled circular waveguides that function as both launch and receive antennas. The waveguides run from the diagnostic first wall (DFW) to the source/detector with the total length of approximately 40 meters. The front end of the LFSR, interfacing with the plasma facing DFW and its supporting diagnostic shielding Modules (DSM), is integrated into equatorial port plug 11 (EPP #11) by the Russian Federal Domestic Agency (RFDA). The LFSR components are required to function in a high temperature, high electromagnetic (EM) field and high nuclear radiation environment in the port zone.
The EM loads are body forces on the metallic components resulting from interaction of eddy currents, induced by the fast plasma current disruption, in the conductive LFSR and port components, with the background magnetic fields from TF, PF and central solenoid (CS) coils. The induced eddy currents in the components are calculated using 68 toroidal filaments on the toroidal perimeter of the plasma, carrying time-varying currents to mimic the ITER current transients. Based on 2D DINA results, and the results of prior full 3D transient simulations of the several worst DINA cases chosen from a 2D DINA scan, a major disruption with downward vertical drift and 16ms exponential current decay time, MDDWEXP16, was considered the most severe scenario for the EPP whole port as well as for the DSMs and the LFSR components therein. The body force density on the conducting structures were mapped onto the finite-element model for structural analyses (coupled with thermal and thermal hydraulic analyses) of the in-vessel components. The effect of the EM laods on the front end components of the LFSR was shown to be small compared with thermal loads. The results of this modeling are presented here.

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