Contribution ID: **3544** Type: **not specified**

P5.1003 ITER disruption simulations with realistic plasma and conductors modelling

Friday, 12 July 2019 14:00 (2 hours)

See full abstract here:
http://ocs.ciemat.es/EPS2019ABS/pdf/P5.1003.pdf

Disruptions are one of the major concerns in ITER and other future tokamaks [1]. In addition to heat, particle flux, and energetic electrons impacting the first wall, significant electromagnetic loads will arise, due to the interaction of eddy and halo currents in the conducting structures with the magnetic field. Reliable modelling tools able to make predictions for future devices are hence fundamental. Two aspects must be considered for a suitable modelling of disruptions. First, a detailed model of plasma is needed, to describe its (possibly unstable) modes of evolution. Here, we use the M3D-C1 code [2], an implicit 3D extended-MHD code that uses high-order C1 continuous finite elements. The second point is an accurate description of the conducting structures surrounding the plasma, whose geometry affects the plasma evolution itself and the actual value of electromagnetic loads. We use the CarMa0NL code [3], to treat an axisymmetric plasma in the evolving equilibrium limit with arbitrary conducting structures, and the CARIDDI code [4], a 3D volumetric eddy currents computational tool. In this paper, we first compare the results of M3D-C1 and CarMa0NL for axisymmetric disruptions, showing that, despite the substantially different assumptions made in the two codes, the predictions are very close, hence increasing confidence in the reliability of the results. Secondly, we describe a coupling scheme between M3D-C1 and CARIDDI, which allows us to use M3D-C1 plasma evolution, in the presence of simplified but realistic wall geometry, as input to subsequent electromagnetic computations made by CARIDDI with a detailed description of the structures. The final aim is to use this coupling scheme also for asymmetric disruptions (AVDEs), in order to quantify the sideway forces expected in ITER.

This work was supported in part by F4E (contract F4E-OPE-0891) and by U.S. DoE Award No. DE-AC02-09CH11466 and the DoE SciDAC Center for Tokamak Transient Simulations.

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Presenter: ISERNIA, N. (EPS 2019)

Session Classification: Poster P5

Track Classification: MCF