Estimations of disruption forces in the COMPASS Upgrade tokamak

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This paper presents the analysis of disruptions in COMPASS Upgrade tokamak [1], which is a medium-size high-magnetic-field device currently in the conceptual design phase. Due to the high plasma current (up to 2 MA) and the strong magnetic field (up to 5 T), large electromagnetic forces on conducting structures surrounding plasma are expected during disruptions. To address this issue, electromagnetic loads on the vacuum vessel during disruptions are estimated analytically using a novel approach to the problem [2]. These analytical results will serve as a baseline for more detailed numerical calculations considering a volumetric 3D description of conducing structures.

The uncertainties in the extrapolation of the available experimental data on disruptions to new tokamaks point at a potential threat to their structural integrity [3]. Therefore, the development of adequate protective means becomes a necessity. For that reason, the possibility of implementation of a disruption force damper (DFD) [4] within the present design constraints is considered.

The study reveals optimal choice of the vacuum vessel parameters which guarantee safe operation of the COMPASS Upgrade tokamak.

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