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CarMa0NL Modelling of Plasma Disruptions on COMPASS-U for Scenarios with Positive and Negative Triangularity

Global and local forces on the wall of COMPASS-U [1,2] tokamak during plasma disruptions are calculated with CarMa0NL code [3] for scenarios with positive and negative triangularities. The COMPASS-U is a high-field tokamak presently in the final design phase. It will operate at the toroidal magnetic field, plasma current and elongation up to B = 5 T, I = 2 MA and κ = 1.8, respectively. Large electromagnetic loads on its vacuum vessel are expected during fast electromagnetic transients, especially for scenarios with strong plasma shaping. The CarMa0NL solves evolutionary equations for 2D plasma in the presence of 3D conductors. In particular, it allows considering the effect of equatorial ports and segmented passive stabilizing plates on plasma dynamics during disruptions and on related force density distribution in the wall. This feature is of special interest for scenarios with negative triangularity due to the possible coupling between plasma and LFS part of the vessel, where 3D features are more significant. The study provides quantitative comparison for total and local forces on tokamak wall for triangularities with opposite polarities.

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2. Yanovskiy, V. V. et al. Comparison of Approaches to the Electromagnetic Analysis of Compass-U Vacuum Vessel during Fast Transients. Fusion Eng. Des. 146, 2338–2342 (2019).
3. Villone, F., Barbato, L., Mastrostefano, S. & Ventre, S. Coupling of Nonlinear Axisymmetric Plasma Evolution with Three-dimensional Volumetric Conductors. Plasma Phys. Control. Fusion 55, 095008 (2013).

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