Comparison of JET AVDE disruption data with MHD simulations and implications for ITER

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Nonlinear 3D MHD asymmetric vertical displacement event (AVDE) disruption simulations have been performed with the M3D 3D MHD code [1], and validated with JET experimetal data. The simulations were initialized with EFIT equilibrium reconstruction of JET disruption shot 71985. Several experimentally measured quantities were compared with the simulation and found in good agreement. The quantities that were compared were vertical displacement and toroidal current, halo current asymmetry [2], toroidal current asymmetry [3], toroidal flux asymmetry [3], and toroidal rotation. The toroidal plasma current is higher at toroidal locations where the plasma position is closer to the wall [3] in both experiment and simulations. This correlation is also demonstrated analytically, without invoking skin currents. The Noll relation [4] between asymmetric wall force and vertical current moment is verified in the simulations. In JET, the resistive wall penetration time, which characterizes the VDE, is much less than the current quench time, $\tau_{wall} \ll \tau_{CQ}$. ITER is expected to be in a different regime, with $\tau_{wall} \geq \tau_{CQ}$. Extrapolating from JET can overestimate the asymmetric wall force in ITER disruptions by an order of magnitude.

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