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Model of vertical plasma motion during the current quench¹

BORIS BREIZMAN, Institute for Fusion Studies, The University of Texas at Austin, DMITRII KIRAMOV, Kurchatov Institute, Moscow, Russia — Tokamak disruptions impair plasma position control, which allows the plasma column to move and hit the wall. These detrimental events enhance thermal and mechanical loads due to halo currents and runaway electron losses. Their fundamental understanding and prevention is one of the high-priority items for ITER. As commonly observed in experiments, the disruptive plasma tends to move vertically, and the timescale of this motion is rather resistive than Alfvénic. These observations suggest that the plasma column is nearly force-free during its vertical motion. In fact, the force-free constraint is already used in disruption simulators. In this work, we consider a geometrically simple system that mimics the tokamak plasma surrounded by the conducting structures. Using this model, we highlight the underlying mechanism of the vertical displacement events during the current quench phase of plasma disruption. We also address a question of ideal MHD stability of the plasma during its resistive motion.

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