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Modeling Fast Thermal Quenches Due to MHD Instabilities During Disruptions[1] NATHANIEL FERRARO, STEPHEN JARDIN, Princeton Plasma Physics Laboratory, BRENDAN LYONS, General Atomics — Simulations of disruptive instabilities, including vertical displacement events and radiative collapse due to impurities, tend to exhibit a common sequence of events, beginning with the contraction of the current channel due to the enhancement of resistivity in the edge. This contraction of the current channel leads to secondary instabilities, which further results in the stochastization of the magnetic field and a rapid thermal quench due to parallel heat conduction to the vessel walls. We present simulations of these events using M3D-C1, an extended-MHD code that now includes a model for the ionization, recombination, radiation, and transport of impurities. This model uses realistic values of resistivity in both the plasma and in the conducting wall, and is able to self-consistently treat the thermal quench, current quench, and resistive wall timescales. These simulations suggest that highly core-localized impurity injection might be necessary to avoid large conductive thermal losses to the wall. We describe ongoing activities to include additional physical effects, including models for runaway electrons and pellet injection for disruption mitigation.

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