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Algebraic motion of vertically displacing plasmas AMITAVA BHATTACHARJEE, DAVID PFEFFERLE, EERO HIRVIJOKI, PPPL — The vertical displacement of tokamak plasmas is modelled during the non-linear phase by a free-moving current-carrying rod coupled to a set of fixed conducting wires and a cylindrical conducting shell. The models capture the leading term in a Taylor expansion of the Green's function for the interaction between the plasma column and the vacuum vessel. The plasma is assumed not to vary during the VDE such that it behaves as a rigid body. In the limit of perfectly conducting structures, the plasma is prevented from coming in contact with the wall due to steep effective potential barriers by the eddy currents, and will hence oscillate at Alfvnic frequencies about a given force-free position. In addition to damping oscillations, resistivity allows for the column to drift towards the vessel on slow flux penetration timescales. The initial exponential motion of the plasma, i.e. the resistive vertical instability, is succeeded by a non-linear sinking behaviour, that is shown analytically to be algebraic and decelerative. The acceleration of the plasma column often observed in experiments is thus conjectured to originate from an early sharing of toroidal current between the core, the halo plasma and the wall or from the thermal quench dynamics precipitating loss of plasma current

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