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Two-dimensional magnetohydrodynamic simulations of poloidal flows and pedestal formation by transonic effects LUCA GUAZZOTTO, University of Rochester, RICCARDO BETTI, University of Rochester and Princeton Plasma Physics Laboratory — Highly sheared poloidal flows are present across the H-mode pedestal. Transonic equilibria produce a radial jump (tangential discontinuity in ideal MHD) in density and poloidal velocity. The tangential discontinuity, required by equilibrium force balance and mass and energy conservation, is not a shock, and there is no flow across the discontinuity. In transonic equilibria edge poloidal velocity exceeds the poloidal sound speed $C_{sp} \equiv C_s B_p/B \sim$ 10s km/s. In the present work, we simulate the time evolution of tokamak plasmas in the presence of a smooth source of poloidal velocity with the 2D resistive-MHD code SIM2D. Simulations include a cold halo region (resistive plasma) outside the plasma, and realistic magnetic configurations, including X-points. Simulations show the formation of a discontinuous profile for velocity and density. Plasma core and magnetic field are not modified by the transient. Remarkably, and differently from equilibrium theory, time-dependent simulations show the formation of a pedestal at all angular locations, due to mass redistribution during the transient.

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