A number of experimental and theoretical studies suggest that the presence of a modest radial shear in the axial plasma flow velocity can provide stabilization of Z-pincha plasmas against the most destructive ideal MHD instabilities (sausage and kink), thereby making the flow stabilized Z-pincha (FSZP) configuration attractive for magnetic fusion energy applications [1]. While radial variations in the plasma flow velocity that occur on the pinch-size scale $a$ can stabilize these large-scale ($k \approx 1/a$) MHD modes, weaker short-scale drift-wave instabilities that occur on a much smaller gyro-Bohm scale ($k \approx Cs/\Omega$) are less affected and can act over time to reduce the velocity shear and degrade the confinement. The effects of drift-temperature gradient modes (entropy modes) on the stability of the shear-flowed Z-pincha configuration are studied numerically in this work via the numerical simulation of the drift-ideal MHD equations [2].

The drift-ideal MHD model is an extension of ideal MHD that includes both thermal pressure and the hall term in Ohm’s law and retains electron heat flux in the energy density equation. The equations are solved numerically in a 2D cylindrical system using the finite-volume method and considering initial profiles that satisfy Z-pincha equilibrium conditions.


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