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Theory of formation of helical structures in a perfectly conducting, premagnetized Z-pinch liner[1] EDMUND YU, Sandia National Labs, ALEXANDER VELIKOVICH, Naval Research Laboratory, KYLE PETERSON, Sandia National Labs — The magnetized liner inertial fusion (MagLIF) concept [1] uses an azimuthal magnetic field to collapse a thick metallic liner containing preheated fusion fuel. A critical component of the concept is an axial magnetic field, permeating both the fuel and surrounding liner, which reduces the compression necessary to achieve fusion conditions. Recent experiments [2] demonstrate that a liner premagnetized with a 10 T axial field develops helical structures with a pitch significantly larger than an estimate of B_z/B_θ would suggest. The cause of the helical perturbations is still not understood. In this work, we present an analytic, linear theory in which we model the liner as a perfectly conducting metal, and study how bumps and divots on its surface redirect current flow, resulting in perturbations to B as well as $j \times B$. We show that in the presence of axial and azimuthal magnetic field, the theory predicts divots will grow and deform at an angle determined by the magnetic field. We compare theoretical results with three dimensional, resistive MHD simulations.

[1] S. A. Slutz et al., Phys. Plasmas 17, 056303 (2010)
[2] T. J. Awe et al., Phys. Rev. Lett. 111, 235005 (2013)

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