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Driven resonant current amplification in sustained spheromak configurations with plasma pressure gradients[1] D.A. SUTHERLAND, T.R. JARBOE, CTFusion, Inc., C.J. HANSEN, University of Washington — High current amplification (CA) sustained spheromaks with pressure confinement ($\beta = 2\mu_o P/B^2 > 0$) are of interest for fusion energy applications to enable sufficiently low recirculating power fractions, high fusion power densities, and relaxed reactor engineering requirements. Driven resonant CA has been previously studied in both fully and partially relaxed force-free spheromak states ($\mathbf{J}||\mathbf{B}$) using an axisymmetric, ideal MHD equilibrium model described by the Grad-Shafranov equation. In this work, this previous analysis has been extended beyond force-free states to now allow for non-zero plasma pressure gradients. An analytical treatment shows that pressure gradients can impact CA under particular profile assumptions, with the ability to enhance or suppress the expected CA relative to comparable force-free states. Computational results with varying poloidal current and pressure profiles suggest a modification of the regularization of Jensen-Chu resonances shown in previous works when calculating nonlinear force-free spheromak equilibria in which $\lambda = \mu_o \mathbf{J}/\mathbf{B}$ spatially varies. The results from this work suggests the persistence of driven resonant CA in sustained spheromaks with pressure confinement, adding further support for the continued research and development of these configurations for fusion energy applications.

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