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Numerical and analytical study of energetic beam ions effects on FRC ELENA BELOVA, Princeton Plasma Physics Laboratory — Simulation studies have demonstrated a stability regime for oblate FRCs with elongation E ~ 1, which requires a close-fitting conducting shell and energetic beam ion stabilization [Belova, Phys. Plasmas 13, 056115 (2006)]. A parameter regime when the beam ion effects are stabilizing for all low-n MHD modes in prolate FRC is yet to be found. In this work the stability properties of a hybrid FRC in which field reversal is created both by plasma currents and by a low-density energetic component of large-orbit ions, have been studied by means of a generalized energy principle, and also by using three-dimensional numerical simulations using the HYM code. The beam ion - thermal plasma interaction term is derived including the effects of radial betatron resonances, and the conditions of the beam ion stabilization for different toroidal mode numbers and mode polarization are compared with simulation results. Relative roles of axial and radial betatron resonances are shown to depend on the FRC kinetic parameter.

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