Analytical equilibrium and interchange stability of single- and double-axis field-reversed configurations inside a cylindrical cavity

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Abstract. This paper reports on the interchange stability of a realistic analytical equilibrium solution of a field-reversed configuration (FRC) contained within a tight fitting cylindrical flux conserver with end walls, no external flux, and arbitrary elongation E. For $E >> 1$, interchange stability is possible with $p_s / p_0 > 7/12$, where p_0 is the peak pressure at the magnetic axis, and p_s is the pressure at the separatrix/wall, a condition that appears to be compatible with high-pressure wall-confined, pulsed FRC implosions. Oblate configurations require somewhat less p_s / p_0 for stability. Analytical equilibria have been found for FRCs with two magnetic axes (doublets) with an internal figure-of-eight separatrix. A striking improvement in stability with respect to interchange modes was found in doublets: the private flux region (core) can be completely stabilized with *zero* separatrix pressure. This new finding suggests that doublet FRCs may be more relevant for steady-state fusion applications, which for good performance nominally require the absence of interchange turbulence as well as low edge-to-core pressure ratios.

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