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Analysis of the nullspace of the MHD force operator in the SIESTA equilibrium code[1] S.P. HIRSHMAN, Oak Ridge National Laboratory, C.R. COOK, University of Wisconsin-Madison, R. SANCHEZ, Universidad Carlos III de Madrid — SIESTA is a three-dimensional magnetohydrodynamics equilibrium code capable of resolving magnetic islands in toroidal plasma confinement devices. The linearized MHD force operator used in the code contains an approximate nullspace of eigenmodes with extremely small eigenvalues. Physically, these correspond to displacements that result in essentially no change in the ideal MHD energy. It will be shown that these modes are aligned with the magnetic field throughout the plasma volume, except in tiny transition layers. As a result, there is a large degeneracy of states that give similar insignificant changes to the energy. These correspond to the least stabilizing modes in a closed, nested flux surface topology. Until a non-ideal perturbation is applied, these nullspace modes that are parallel to the magnetic field will dominate the plasma displacement direction in a nonlinear energy minimization technique such as that used in SIESTA. The eigenmodes will be shown throughout the plasma volume, and the effects on the spectrum of the different convergence techniques used in SIESTA will be discussed. The results give confirmation to analytical methods used to minimize the MHD energy.

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