## Abstract

The magnetohydrodynamic (MHD) and two fluid growth rates of a low $\beta$ $m = 2/n = 1$ tearing mode in the presence of well-separated central sawtooth oscillations are examined using new reconstructions of experimental equilibria in the DIII-D tokamak [J.L. Luxon and L.G. Davis, Fusion Technol. **8**, 441 (1985)]. The linear resistive stability index $\Delta'$ alone is insufficient for determining the mode stability in toroidal geometry. Coupling to other rational surfaces is important even at low $\beta$. For the cases considered here coupling to the 1/1 is stabilizing while coupling to the 3/1 is destabilizing. Matching the outer ideal MHD solution to the inner tearing layer solutions can change the marginal point depending on the inner layer model. The PEST3 code [A. Pletzer, A. Bondeson and R.L. Dewar, J. Comp. Phys. **115**, 530 (1994)] is used to determine matrix solutions for the ideal MHD $n = 1$ mode that have singular jumps at each of the rational surfaces $q = 1, 2$, and 3. This outer region solution is matched asymptotically to the desired resistive MHD inner layer solutions of Glasser, Greene and Johnson, where the interchange parameter $H$ is small in the low $\beta$ DIII-D plasma, while the inverse $\beta$ parameter $G$ is large. The most important effects in the dispersion relation are found to be the resistive interchange parameter $D_R$ and the coupling to the 1/1 surface. Two-fluid diamagnetic effects were examined only in the uncoupled case, and modify the growth rate significantly. Both electron and ion diamagnetic effects are important at large diamagnetic frequencies $\omega_{*i} >> \gamma_{MHD}$ and $T_e \simeq T_i$.



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