Dependency of Tearing Mode Stability on Current and Pressure Profiles in DIII-D Hybrid Discharges

K. KIM, SNU/ORAU, J.M. PARK, M. MURAKAMI, ORNL, R.J. LA HAYE, General Atomics, Y-S. NA, SNU; DIII-D Team — Understanding the physics of the onset and evolution of tearing modes (TMs) in tokamak plasmas is important for high-β steady-state operation. Based on DIII-D steady-state hybrid experiments with accurate equilibrium reconstruction and well-measured plasma profiles, the 2/1 tearing mode can be more stable with increasing local current and pressure gradient at rational surface and with lower pressure peaking and plasma inductance. The tearing stability index $\Delta'$, estimated by the Rutherford equation with experimental mode growth rate was validated against $\Delta'$ calculated by linear eigenvalue solver (PEST3); preliminary comprehensive MHD modeling by NIMROD reproduced the TM onset reasonably well. We present a novel integrated modeling for the purpose of predicting TM onset in experiment by combining a model equilibrium reconstruction using IPS/FASTRAN, linear stability $\Delta'$ calculation using PEST3, and fitting formula for critical $\Delta'$ from NIMROD.

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