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RWM Stabilization to Sustain High Normalized Beta at Low Internal Inductance in NSTX* J.W. BERKERY, S.A. SABBAGH, J.M. BIALEK, O. KATSURO-HOPKINS, Columbia U., R.E. BELL, S.P. GERHARDT, B.P. LEBLANC, PPPL, K. TRITZ, JHU — Spherical torus fusion applications aim to operate at high normalized beta, β_N, and non-inductive current fraction. These plasmas exhibit broad current profiles and low plasma internal inductance, ℓ_i. In NSTX, such plasmas show a significant reduction of the ideal $n = 1$ no-wall stability limit at $0.4 < \ell_i < 0.6$. High $\beta_N > 6$ is reached, exceeding the ideal limit by a factor of two. Plasmas below this ℓ_i range are computed to be near the current-driven ideal kink stability limit, where mode stabilization is required at finite beta. Two active control approaches are used: (i) combined use of radial and poloidal field resistive wall mode (RWM) sensors with $n = 1$ proportional gain feedback and (ii) an RWM state-space controller including an unstable RWM eigenfunction model and currents induced in nearby 3D conducting structure. Long-pulse plasmas reached $\beta_N/\ell_i > 13$. Disruption probability was significantly reduced in plasmas at high $\beta_N/\ell_i > 11$ with more disruptions seen at lower β_N/ℓ_i consistent with theory showing decreased passive RWM stabilization at intermediate plasma rotation levels. New independent control of the six actuator coils will allow the RWM state space controller to produce mode control field spectra with $n > 1$. *Work supported by U.S. DOE Contracts DE-FG02-99ER54524 and DE-AC02-09CH11466.

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