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Control Development for NSTX and the Effects of Strong Shaping EGEMEN KOLEMEN, PPPL, D.A. GATES, S.P. GERHARDT, D.A. HUMPHREYS, D. MUELLER, V. SOUKHANOVSKII, M.L. WALKER — New shape control implementations and the effects of the strong shaping on the NSTX are summarized. Spherical Tokamak devices all operate at high elongation in order to maximize the bootstrap fraction and q^*. In addition, the location of the outer strike point must often be fixed for effective divertor operation. As a result, neither the plasma elongation nor the triangularity can be modified greatly. An additional shape parameter that can help optimize plasma stability is the plasma squareness. Squareness control was implemented in 2010 and in this paper the effects of squareness variation on stability and plasma performance are presented. NSTX by design has a thin center column, which does not allow placing polodial field (PF) coils to directly control the inner plasma boundary. Controlling the full plasma boundary therefore needs the combined effort of all the PF coils. A multi-input-multi-output (MIMO) control law for the full plasma was developed. A snowflake divertor configuration is currently being tested to enable higher-power operations in NSTX-Upgrade and a new control algorithm to enable these operations was developed. Experiments are planned to test the MIMO and snowflake controls and the effects of the enhanced shape control on the plasma performance and stability. Work supported by U.S. DOE Contract DE-AC02-09CH11466.

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