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Predictive Control of the Rotation Profile using Neutral Beam Injection and Variable 3D Magnetic Fields[1] W.P. WEHNER, General Atomics, M.D. BOYER, PPPL, D.A. HUMPHREYS, General Atomics, N.C. LOGAN, PPPL, E. SCHUSTER, Lehigh — Model predictive control (MPC) of the rotation profile using a control-oriented momentum balance model which incorporates empirical models of the NBI and 3D field torques has been developed for DIII-D. Tokamak plasma rotation is widely recognized to significantly affect the energy confinement, plasma stability, and access to high performance operating scenarios. In this work, a generalized control capability for aiding rotation-related physics studies is developed. To obtain a control-oriented model, a simplified version of the momentum balance equation is combined with empirical models of the momentum sources. Recent progress in modeling the torque density profile driven by 3D fields as a function of the non-axisymmetric field coil currents has been embedded into the control design (N.C. Logan EPS 2018). MPC is well suited to a variety of control objectives because it can explicitly incorporate various types of constraints. For example, control of the edge rotation to adjust the ELM suppression threshold while fixing the stabilizing $q = 2$ rotation. A simulation study is presented to demonstrate the control performance and flexibility of the approach.

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