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Accessibility and Reproducibility of Stable High-q_{min} Steady-State Scenarios by q-profile+β_N Model Predictive Control[1] E. SCHUSTER, W. WEHNER, Lehigh University, C.T. HOLCOMB, B. VICTOR, LLNL, J.R. FERRON, T.C. LUCE, General Atomics — The capability of combined q-profile and β_N control to enable access to and repeatability of steady-state scenarios for q_{min} >1.4 discharges has been assessed in DIII-D experiments. To steer the plasma to the desired state, model predictive control (MPC) of both the q-profile and β_N numerically solves successive optimization problems in real time over a receding time horizon by exploiting efficient quadratic programming techniques. A key advantage of this control approach is that it allows for explicit incorporation of state/input constraints to prevent the controller from driving the plasma outside of stability/performance limits and obtain, as closely as possible, steady state conditions. The enabler of this feedback-control approach is a control-oriented model capturing the dominant physics of the q-profile and β_N responses to the available actuators. Experiments suggest that control-oriented model-based scenario planning in combination with MPC can play a crucial role in exploring stability limits of scenarios of interest.

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