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[ ] Theory [X] Experiment

Backstepping Control of the Current Profile in the DIII-D Tokamak,* M.D. Boyer, J. Barton, E. Schuster, *Lehigh University;* M.L. Walker, D.A. Humphreys, *General Atomics* – Control of the spatial profile of the plasma current in tokamaks has been demonstrated to be a key condition for advanced scenarios with improved confinement and steady-state operation. Non-model-based controllers tested at DIII-D have shown limitations, motivating the design of model-based controllers that account for the dynamics of the q profile. In this work, we utilize a control-oriented model of the current profile evolution in DIII-D to design a backstepping boundary control law for regulating the current profile around a desired feed-forward trajectory. The control scheme makes use of the total plasma current, total power, and line averaged density as actuators. A simulation study is done to test the control law against uncertainties in the model parameters and initial conditions, as well as input disturbances. Finally, the implementation of the controller in the DIII-D plasma control system is discussed and experimental results are presented.

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