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Data-Driven Modeling and Control of the Poloidal Flux Profile for Advanced Tokamak Scenarios in DIII-D[1] W. WEHNER, W. SHI, E. SCHUSTER, Lehigh University, D. MOREAU, CEA IRFM, M.L. WALKER, J.R. FERRON, General Atomics — Theory-based mathematical models derived from flux averaged transport equations may result in complex expressions not suitable for real-time control implementation. At the expense of less model accuracy and controller capability, data-driven linear models constructed from system identification techniques offer a potentially practical and relatively simple alternative suitable for control design when the goal is regulation around an equilibrium point. This work considers the evolution of the poloidal flux profile in response the inductive electric field as well as to heating and current drive (H&CD) systems. Based on the identified linear models, an optimal state feedback controller with integral action is designed to regulate the poloidal flux profile around a desired target in the presence of perturbations. Closed-loop experiments on DIII-D and simulations based on predictive codes illustrate the effectiveness of the controller.

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