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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.
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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 con-
troller 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 elec-
tric 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 pres-
ence of perturbations. Closed-loop experiments on DIII-D and simulations based on
predictive codes illustrate the effectiveness of the controller.

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