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Category Number and Subject: 6.1.3 Plasma Control Systems or 5.6.2 DIII-D Tokamak

[ ] Theory [X] Experiment

Tracking of Current and Rotation Profile Evolution in the DIII-D Tokamak via System Identification, *William Wehner, Chao Xu, Eugenio Schuster, *Lehigh University*; M.L. Walker, D.A. Humphreys, *General Atomics*; Yongkyoon In, *FarTech Inc.* – Transport theories produce nonlinear models based on partial differential equations (PDEs) whose complexity often renders them difficult to use for control design. As an alternative, data-driven modeling techniques involving system identification have the potential to obtain practical, low-complexity, dynamic models for the control of plasma systems. The plasma dynamics is first assumed to be governed by a tractable model with unknown and to-be-estimated transport coefficients. After discretizing both in space and time, the system states and to-be-estimated coefficients are combined into an augmented state vector. The resulting nonlinear state-space model is used for the design of an extended Kalman filter that provides real-time estimates not only of the system states but also of the unknown transport coefficients required by the current and rotation feedback controllers.

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