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

[ ] Theory [X] Experiment

Data-driven Model-based Combined Magnetic and Kinetic Control on DIII-D,* W. Shi, W. Wehner, J. Barton, M.D. Boyer, E. Schuster, *Lehigh University;* D. Moreau, *CEA IRFM;* M.L. Walker, J.R. Ferron, *General Atomics* – In order to take into account the coupling between the different magnetic and kinetic parameters, a multi-input-multi-output (MIMO) model-based controller is introduced to regulate the rotational transform profile and β_N in DIII-D. This approach is based on a linear two-time-scale model derived from experimental data. A singular value decomposition of the plasma model is carried out to decouple the system and identify the most relevant control channels. Then, a robust-control technique is used to determine a controller that minimizes the reference tracking error and rejects external disturbances with minimal control energy. Finally, the feedback controller is augmented with an anti-windup compensator, which keeps the given controller well behaved in the presence of actuator saturation. Experimental results illustrate the performance of the proposed controller, which is one of the first plasma profile controllers integrating magnetic and kinetic variables implemented in DIII-D.

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