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Current Density Profile Estimation via Model-based Extended Kalman Filtering in the DIII-D Tokamak[1] H. WANG, J.E. BARTON, E. SCHUSTER, Lehigh U. — A closed-loop observer for the estimation of the poloidal magnetic flux profile has been proposed for tokamaks in which the profile cannot be accurately estimated in real time via equilibrium reconstruction methods due to the lack of internal diagnostics. The observer has been synthesized by applying extended Kalman filtering theory and using a discrete lumped-parameter nonlinear model based on the magnetic diffusion equation. The observer makes use of measurements of the total plasma current and the poloidal magnetic flux at both the magnetic axis and the plasma boundary to estimate the full magnetic flux profile. DIII-D has the capability of accurately reconstructing the poloidal magnetic flux profile by incorporating measurements by the Motional Stark Effect (MSE) diagnostics in the real-time equilibrium code, which makes it a perfect testbed for the proposed observer. Comparisons between estimated (by observer) and reconstructed (by equilibrium code) magnetic flux profiles are carried out for several discharges in the DIII-D tokamak, demonstrating the potential of the proposed observer.

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