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Model-Based Design for Operational Plasma Shape Control in DIII-D,* M.L. Walker, D.A. Humphreys, J.A. Leuer, *GA*; B. Xiao, *ASIPP*; S.H. Hahn, *NFRC*; E. Schuster, Y. Ou, M. Alsarheed, *Lehigh*; D. Gates, *PPPL*; T.A. Casper, W.H. Meyer, *LLNL* – Formerly, tokamak plasma control emphasized empirical tuning of simple controllers during experimental operations. Now, physics-based tokamak plasma response models are maturing and increasingly used as the basis for control design. This is essential for controller development for devices under design or construction, and key to maximizing the physics productivity of limited experimental time in operating devices. We report on experience at DIII-D and other tokamaks with shape control algorithms developed using physics-based models. We also describe a large and growing collection of Matlab functions, collectively known as the Tokamak System (TokSys) Toolbox, which standardizes much of the process of development and validation of tokamak plasma response models. Such standardization enables rapid model development, validation, and control design for operating and planned devices. Application to control development for several devices is described.

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