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Comparison of Data-Driven and First-Principles Model-Based Control Approaches for Regulation of the Poloidal Flux Profile and β_N in DIII-D Advanced Tokamak Scenarios[1] W. WEHNER, W. SHI, E. SCHUSTER, Lehigh U., M.L. WALKER, D.A. HUMPHREYS, GA — Modeling of the coupled evolution of the poloidal flux profile and β_N in response to the heating and non-inductive current drive systems (neutral beam and electron cyclotron powers) as well as to the total inductive plasma current is carried out in this work with the ultimate goal of employing the developed models for control design. The modeling process follows two distinct approaches: data-driven modeling and first principles modeling. Using each model separately to design and test a controller for the regulation of the poloidal flux profile and β_N around desired operating points, the advantages and limitations of the two approaches are compared. This study represents one of the first steps towards defining the modeling needs for successful model-based current-profile control in present and future devices. Results from numerical and experimental testing in the DIII-D tokamak are presented.

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