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Time-dependent Modeling of Feedback Control of MHD Instabilities in DIII-D[1] A. VAN ETTEN, U. Washington, A.M. GAROFALO, H. REIMERDES, Columbia U. — Feedback control of the long-wavelength resistive wall mode (RWM) using magnetic coils in DIII-D has allowed reliable tokamak operation at normalized pressure exceeding the free-boundary limit by up to a factor of 2. The feedback system senses the resonant response of the stable RWM to intrinsic field asymmetries, yet the effects of the feedback action depend strongly on the algorithm used. A "smart shell" algorithm can only reduce the plasma response to the error field, while a "mode control" algorithm can effectively remove the error field itself, thus maintaining the fluid rotation speed necessary to stabilize the RWM. Time-dependent simulations using an ideal MHD model support this interpretation. The time-dependent formulation of the feedback model also allows investigation of nonlinear feedback behaviors, such as the effects of voltage and current limits. In the experiment, these hardware limitations are observed to provide system stability under circumstances that, in linear analysis, are predicted to lead to instability.

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