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Advanced RWM Feedback with Truncated Balanced Realization
DOV RHODES, J. BIALEK, A.H. BOOZER, M.E. MAUEL, D.A. MAURER, G.A. NAVRATIL, N. RATH, Columbia University — Stabilizing the resistive wall mode (RWM) requires advanced control techniques. State-space methods such as truncated balanced realization have shown promise in VALEN simulations [1]. Advanced control theory is particularly relevant to large tokamaks such as ITER. In this presentation, we make use of a balanced realization, which highlights the plasma modes that are simultaneously controllable and observable, and optimizes the efficiency of the controller. Furthermore, the *truncated* balanced realization approximates the system with a reduced model in order to minimize the computational load, a critical factor in real-time control of large systems. Since finding the optimal truncation remains an open problem [2], it is essential to compare the effectiveness of different truncation models with the full balanced realization, as well as other control schemes. We present theoretical and simulation-based predictions of the different feedback models, soon to be implemented in real-time using a GPU computer at HBT-EP.

[1] Katsuro-Hopkins, O., et al. 2007 *Nucl. Fusion* **47**, 1157.
[2] Dullerud, G.E. & Paganini, F. *A Course in Robust Control Theory* . Springer: 2000.

David Maurer
Columbia University

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