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Magnetohydrodyamic mode feedback control using all components of $\tilde{B}$ in the presence of two resistive walls for reversed field pinches
K. SASSENBERG, University of Tulsa, A.S. RICHARDSON, Naval Research Laboratory, D.P. BRENNAN, University of Tulsa, J.M. FINN, Los Alamos National Laboratory — A theoretical and computational analysis is presented of magnetohydrodynamic instability control through sensing and proportional feedback in Reversed Field Pinches (RFPs) with two resistive walls. The feedback signal incorporates all three components of the magnetic field perturbation at variable locations, each with its own gain factor and important features of the RFX-mod experiment, namely two resistive walls with measurements taken in between. Depending on the nominal magnetic flux diffusion times of the walls the two wall scenario reflects the physics of the one wall scenarios with measurements taken inside and outside. Therefore studies with a single wall provides the key to understanding the more physically relevant two wall results. It is found that feedback control can stabilise the plasma in the presence of two walls and at currents much larger than the ideal wall tearing limit, but less than the upper bound set by the one wall scenario with the derivative of the helical flux measured inside. Furthermore, when a thick wall formulation is considered high frequency magnetosonic modes were found to be stable, demonstrating the thin wall approximation is sufficient when selectively treating the comparatively low frequency tearing mode and ignoring the magnetosonic mode.

K. Sassenberg
University of Tulsa

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