# STRUCTURE AND FEEDBACK STABILIZATION OF RESISTIVE WALL MODES IN DIII-D*

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Active magnetic feedback stabilization experiments on the DIII-D tokamak have succeeded in suppressing the n=1 resistive wall mode (RWM) for periods more than fifty times longer than the resistive penetration time of the surrounding vessel wall. In the absence of closed-loop stabilization, resistive wall modes limit the performance of DIII-D discharges when the plasma beta exceeds the no-wall ideal stability limit. Efforts to stabilize these slowly growing, slowly rotating, n=1 global kink modes in DIII-D by passive means, such as careful correction of magnetic field errors to reduce braking of the toroidal plasma rotation, have managed to delay onset of the modes. However, sustained operation above the no-wall limit has only been achieved with active feedback techniques. In the feedback stabilization experiments on DIII-D, the radial magnetic field perturbations arising from growth of RWMs are detected by six large-area external sensor loops, each covering a 60° arc on the vessel midplane. Various logic schemes are used to convert the measurements into commands for applying power to the corresponding three diametrically opposed pairs of active coils. Mode detection is augmented by two additional 12-loop arrays of external saddle loops, above and below the midplane array. Analysis of soft x-ray data from two identical poloidal arrays, separated toroidally by 150°, together with measurements from the 30-loop external $\delta B_r$ sensor system and a diametrically opposed pair of internal $\delta B_p$ magnetic probes, has demonstrated the expected global kink nature of resistive wall modes. Furthermore, in experiments up to now, the basic mode structure has remained unchanged in the presence of magnetic fields from the active coils, except for the expected reduction in amplitude. These observations are in agreement with recent code calculations and support the assumption of mode rigidity in formulations of the feedback stabilization process. Experiments in 2001 will make use of an extensive new set of sensor loops and magnetic probes, situated inside the vacuum vessel underneath protective carbon tiles. Modeling indicates that the new internal sensors should be more effective than external sensors in active control of resistive wall modes.

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