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Feedback Stabilization of Resistive Wall Modes in RFX-mod

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The search of efficient strategies for active control of MHD instabilities is one of the main missions of existing devices and one active field of research where important contributions can come not only from tokamak devices but also from alternative configurations. Resistive Wall Mode (RWM) instabilities are known in particular to limit plasma performances in all toroidal devices with plasma duration exceeding the penetration time of the resistive magnetic boundary surrounding the plasma. RWMs are the main limit for tokamak high-beta advanced scenarios, where a high fraction of non-inductive current is requested to study long (in the limit steady state) operations. Historically RWMs were first observed in Reversed Field Pinch (RFP) devices, where the current gradient plays the role of the drive, typically with multi-mode spectrum whose composition depends on magnetic equilibrium field profiles. RFX-mod device is a large RFP (R=2 m, a=0.46 m) where active control of MHD instabilities is intensively studied by means of a system of 192 active saddle coils placed outside the resistive shell (50 ms for Bv diffusion time) fully covering its external surface and driven by a digital controller. This system provides a very powerful and flexible environment where the study of RWMs physics and their active stabilisation under different experimental conditions is possible. Recent results from RFX-mod show that the complete stabilisation of multi-mode RWM spectrum at high plasma currents (Ip=1 MA) is possible allowing discharges longer than 6 times the diffusion time of the shell. Different control schemes are tested as well, such as open loop operations (intrinsic error field correction and Resonant Field Amplification studies), feedback operations using different measurement systems or incomplete set of coils to simulate systems with partial coverage by active coils.