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EX/P4-21: Experimental Studies of the Plasma Response to Applied Nonaxisymmetric External Magnetic Perturbations in EXTRAP T2R

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The EXTRAP T2R resistive wall mode feedback control system, along with new control algorithms has enabled experimental studies of the interaction of external magnetic perturbations with the plasma. Application of low amplitude transient, broad-spectrum magnetic perturbations in parallel with feedback stabilization enables non-destructive measurement of RWM growth rates. It is found that the obtained eigenmode spectrum compares well with cylindrical ideal MHD thin resistive wall theory. Resonant external magnetic perturbations have been applied to study the interaction with magnetic islands. A stationary perturbation leads to braking of the magnetic island rotation and locking of the island position. When the magnetic island is close to complete locking, regular phase flips are seen correlated with large island amplitude variations. Stationary resonant magnetic perturbations have been applied to study how local electromagnetic torques at the resonant surface brakes the plasma rotation. The electromagnetic torque affects first the rotation at the resonant surface, and then the effect propagates across the rotation profile. Non-resonant magnetic perturbations may affect the plasma rotation through neoclassical toroidal viscosity. Application of a non-resonant external perturbation shows reduction of the fluid velocity over the core region, demonstrating a non-local braking effect. The capabilities of the control coils have been utilized for studying the role of varying perturbation harmonic. Resonant magnetic perturbation penetration into the plasma may be reduced by plasma flow screening. This effect is studies by generating a RMP that interacts with a tearing mode (TM), while the flow velocity is changed by applying a second perturbation that is non-resonant, thus producing a flow reduction without perturbing significantly other parameters. By modifying the amplitude of the non-RMP, the degree of RMP penetration has been studied at varying plasma flow velocity.

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