

Non-axisymmetric magneto-hydrodynamic equilibrium in the presence of internal magnetic islands and external magnetic perturbation coils

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Abstract. Non-axisymmetric equilibria arise in DIII-D discharges that are subjected to magnetic perturbation by 3D magnetic coils. But, 3D shaping of the entire plasma, including the boundary, also occurs in the rotating fluid frame of saturated internal magnetic islands [1]. This is advantageous since internal islands and kink responses that rotate near the fluid velocity of the plasma are easily diagnosed, while static perturbations in the laboratory frame are not. The helicity of the perturbed shape is the same in both rotational frames of reference, making one mode a diagnostic proxy for the other and allowing internal modes to be used as a source of data for comparison to models typically applied to understanding the effect of static perturbations. Discrepancies with ideal magneto-hydrodynamic (MHD) equilibrium obtained by the IPEC [2] method brings attention to the treatment of plasma displacements near rational surfaces and their relationship to the accessibility of equilibrium states.