Linear ideal MHD predictions for $n = 2$ non-axisymmetric magnetic perturbations on DIII-D

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Abstract. An extensive examination of the plasma response to dominantly $n = 2$ non-axisymmetric magnetic perturbations (MPs) on the DIII-D tokamak shows the potential to control 3D field interactions by varying the poloidal spectrum of the radial magnetic field. The plasma response is calculated as a function of the applied magnetic field structure and plasma parameters, using the linear magnetohydrodynamic code MARS-F [Y. Liu, et al., Phys. Plasmas **7**, 3681 (2000)]. The ideal, single fluid plasma response is decomposed into two main components: a local pitch-resonant response occurring at rational magnetic flux surfaces, and a global kink response. The efficiency with which the field couples to the total plasma response is determined by the safety factor and the structure of the applied field. In many cases, control of the applied field has a more significant effect than control of plasma parameters, which is of particular interest since it can be modified at will throughout a shot to achieve a desired effect. The presence of toroidal harmonics, other than the dominant $n = 2$ component, is examined revealing a significant $n = 4$ component in the perturbations applied by the DIII-D MP coils; however, modeling shows the plasma responses to $n = 4$ perturbations are substantially smaller than the dominant $n = 2$ responses in most situations.

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