M3D-C^1 Simulations of the Plasma Response to Externally Applied Magnetic Perturbations in NSTX-U Snowflake Divertor Configurations

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Understanding the nature of the plasma response to small resonant and non-resonant 3D magnetic perturbations applied by non-axisymmetric coils is essential to suppress or mitigate Edge Localized Modes (ELMs) without significantly impacting the plasma performance or core stability. However, even with complete suppression or mitigation of ELMs achieved, the handling of the exhaust power can still be problematic in reactor-size machines like DEMO since conventional divertor solutions are expected to be insufficient to keep the divertor heat loads within the operating limits of the plasma-facing components [1]. The "snowflake" (SF) divertor [2] is one of several magnetic divertor configurations that have been proposed as a potential way to reduce the divertor heat loads. Therefore, it is also essential to investigate the effect of 3D magnetic perturbations in plasmas with a SF divertor configuration. This work reports on resistive magnetohydrodynamic simulations, performed using the M3D-C^1 code [3], of the plasma response to n = 3 magnetic perturbations applied to NSTX-U plasmas with various SF divertor configurations. The simulations are performed for SF configurations with various distances between primary and secondary x-points, various values of ion effective charge (Z_{eff}) and for various values of current in the NSTX-U non-axisymmetric magnetic perturbation coils. Preliminary results show that higher values of Z_{eff} tend to reduce the plasma response. Single- and two-fluid plasma simulations will be presented and compared with calculations based on the vacuum approach.

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