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Identification of multi-mode plasma response and extraction of plasma transfer function in tokamaks[1] Z.R. WANG, Princeton Plasma Physics Lab, Y.Q. LIU, CCFE Culham Science Centre, J.K. PARK, PPPL, M.J. LANCTOT, GA, Y.W. SUN, Institute of Plasma Physics, C. PAZ-SOLDAN, GA, N. LOGAN, Princeton Plasma Physics Lab, J. MENARD, R. NAZIKIAN, PPPL
— Plasma response, is key to ELM control using magnetic coils and has been extensively measured in tokamak experiments. In this work, a modified Nyquist analysis, including both coil phase and frequency scan, is developed to analyze the plasma response for directly identifying the multiple modes responses with the stable plasmas. The method, combined with the Pade approximation, can extract the plasma transfer functions through the magnetic response measurements, providing in-depth physics understanding. The eigenvalue in the transfer function can quantitatively infer the plasma stability. The transfer function can be applied to optimize the coil configuration to amplify the preferred eigenmode for potential ELM suppression. The drift-kinetic effects modifying the plasma response [2] can be further validated. In this work, these aspects are studied with the simulated response based on various experiments including NSTX, DIII-D and EAST. The preliminary application of this modified Nyquist analysis on existing DIII-D experiments [3] indicates the feasibility of applying the method in experiments. [1] Work under DE-FC02-04ER54698 and DE-AC02-09CH11466; [2] Z.R. Wang et al, Phys, Rev. Lett. 114, 145005 (2015); [3] C. Paz-Soldan et al, Phys, Rev. Lett. 114, 105001(2015)

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