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Destabilization of resistive plasma resistive wall mode by anisotropic thermal transport

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Both an analytic model and the toroidal MARS-F/K code have been employed to study the effect of the anisotropic thermal transport on the stability of the resistive wall mode (RWM) in resistive tokamak plasmas. The results show that thermal transport destabilizes the resistive plasma RWM, by effectively eliminating the Glasser-Green-Johnson favorable average curvature stabilization associated with the resistive layer. Modification of the mode eigenfunction is also observed in MARS-F computations, due to the presence of the anisotropic thermal transport. Furthermore, kinetic contributions of the trapped energetic particles (EPs) and thermal particles (TPs) are taken into account in both analytic model and MARS-K code to investigate the effect of anisotropic thermal transport.

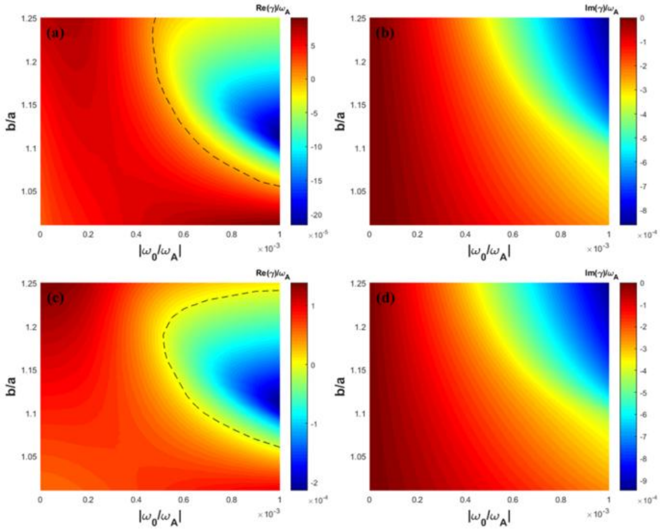

Fig. 1. The (a,c) growth rate, and (b,d) real frequency, of the n=1 PRRWM with varying wall radius b/a and the plasma toroidal rotation frequency w_0 (normalized by the Alfven frequency w_A), as calculated by the analytic model. Compared are the case without (a,b) and with (c,d) thermal transport terms (TTT). Dashed lines indicate marginal stability of the mode.

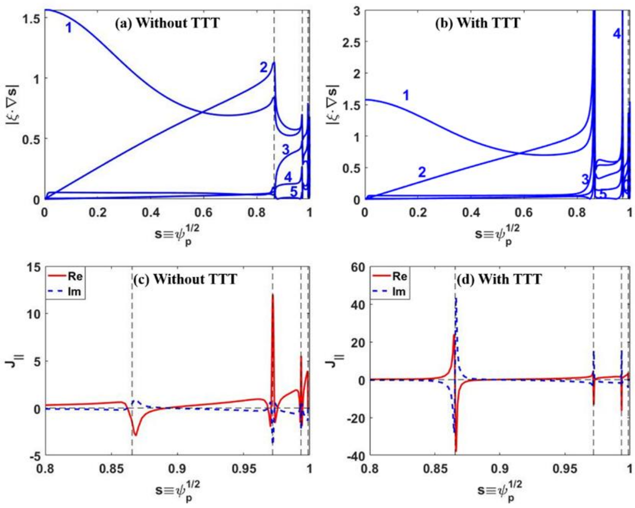

Fig. 2. Radial profiles of the poloidal Fourier harmonics for (a,b) the radial displacement, and (c,d) the m/n=2/1 perturbed parallel plasma current density, associated with the n=1 RPRWM computed by MARS-F. Solid (dashed) curve in (c,d) denotes the real (imaginary) part of the perturbed parallel current. Compared are the eigenmode structures between the cases without (a,c) with (b,d) TTT.

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